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ABSTRACT

Reported are the results of a series of studies conducted to identify the possible correlates of perceptual curiosity in retarded and normal IQ Ss (13-21 years old), and to determine the modifiability of perceptual curiosity in mentally retarded Ss through training and the possible transfer effects of such training. In a section on general methodology, brief descriptions are given for Ss, stimuli, procedure, apparatus, instructions, and procedural variations. Methodology and results for each study are reported separately under the following research topics: perceptual curiosity characteristics--distributions, item differences, and transitivity effects; distribution of perceptual curiosity characteristics in non-retarded adolescents and young adults; development of the 30-item short technique; comparison of retardates and normals for distribution and transitivity effects; comparison of forced-choice and fixation methodologies in non-retarded Ss; perceptual curiosity in retarded and normal IQ adolescents--effects of age, trials, sex, complexity dimensions, type of pairing, and IQ level; decision-time and duration of responses to stimulus complexity; exploration for correlates of perceptual curiosity; modification of perceptual curiosity behavior through training; and transfer of perceptual curiosity training to subsequent tasks. It is concluded that the findings suggest that special class teachers should support and encourage exploratory activity, even if it is rudimentary, whenever it occurs. Among appendixes are studies on complexity choice as a function of exposure time and pupillary changes in retarded and normal IQ adolescents as functions of stimulus complexity. (SBH)

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Curiosity Behavior in Educable Mentally Retarded and Normal Adolescents: Characteristics, Modifiability, and Consequences of Training

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I. Introduction

It is reasonably axiomatic that active acquisition of knowledge requires that the learner maintain an awareness of and attention to the sources which will provide that knowledge. That is to say, attention to informational resources (e.g., materials, the teacher, the learning context) is a necessary if insufficient condition to the active learning of any new information which those resources may potentially impart. Such attention may be insufficient because the learner may not possess the necessary behavioral skills, apparatus, or repertoire to appropriately incorporate or process the new information. And, attention to informational resources may not be necessary in passive learning, at least according to some conceptualizations, e.g., the Pavlovian view of conditioned-reflex acquisition. However, it is reasonable to assert that a great deal of if not most significant human learning, especially in formal settings such as the classroom, is dependent upon the learner actively seeking acquisition of information being imparted. In turn, as already noted, such active posture towards new information depends upon attention to the appropriate informational resources.

Compatible with the foregoing, a number of writers (e.g., Harlow, 1953; Montgomery, 1954; McReynolds, 1963; Berlyne, 1960; Fiske & Maddi, 1961, have argued generally and presented data to support the contention that many species, including humans, are prompted or aroused by novel, surprising, or otherwise variable stimulus effects in their environments. While the terminology is not entirely satisfactory, such stimulus effects can be generally described as falling into various categories of stimulus complexity.[1] That is, novel or surprising stimulus effects may be described as more complex than a predictable effect; similarly, stimuli in a series which are variable with respect to each other may be described as more complex than another series with relatively less inter-stimulus variability.

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[1] Berlyne (e.g., 1966) has described such stimulus characteristics generically as collative variables.

Methodologically, studying the effects of stimulus complexity typically involves a situation where a subject is presented with an array or series of two or more stimuli (or more properly sub-stimuli) that are contrasted with respect to some attribute of complexity. Sub-stimuli in the array or series may vary along many lines, e.g., the degree of symmetry for the arrangement of elements in the stimuli or of their configurational boundaries, the homogeneity of elements in the stimuli, the quantity of elements, and the congruity of stimulus characteristics in terms of their correspondence to common expectations, among other possible attributes. The most typical response variable associated with studies of stimulus complexity effects is some variant of the orienting response, such as time the subject fixates on a complex sub-stimulus relative to fixation time on a less complex sub-stimulus (e.g., Berlyne, 1957), or a more molar response variable such as choice among sub-stimuli of varying complexity (e.g., Maw and Maw, 1962; Hoats, Miller and Spitz, 1963). More recent studies have considered the amount of effort expended by a subject on apparent behalf of maintaining a complex stimulus in the subject's field, as another approach to studying complexity effects.[2]

The general thesis which many workers in the field offer is that relative stimulus complexity evokes from an organism a tendency to explore or manipulate the attributes of his environs, more than would be the case if the stimulus configuration were relatively less complex. This tendency has been termed perceptual curiosity (Berlyne, 1954). While there appear to be factors which constrain the extent to which stimuli of given complexity levels evoke perceptual curiosity, it may be tentatively stated that stimulus complexity and subjects' perceptual curiosity bear a roughly direct relationship to each other, i.e., the more the complexity, the greater the curiosity. From the standpoint of learning, it is reasonable to assume that the acquisition of new information will be facilitated (but of course, not necessarily satisfied) by perceptual curiosity on the part of the learner, since this phenomenon will presumably "set" the learner for such informational acquisition.

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[2] E.C. Butterfield and G.N. Siperstein, personal communication.

Among the possible factors which may constrain the probability that a complex stimulus will evoke perceptual curiosity, at least the following can be considered. One is that a subject may not be able to adequately discriminate between relatively more or less complex attributes of a given stimulus array. A second possibility is that the subject does not possess the appropriate response repertoire to execute a response that can be meaningfully considered as indicative of curiosity. In these regards, however, very young infants, including neonates, have shown evidence of systematically greater attention to relatively more complex over less complex visual stimuli (e.g., Fantz, 1963). Further, in a study of the effects of medication during labor on the visual exploratory behavior of neonates, Stechler (1964) found that infants whose mothers had received medication showed greater attention to complex than to more simple stimuli, although their total fixation time over all classes of stimuli was significantly less than that for the infants of unmedicated mothers. Thus, the primitive repertoire of neonates, even those showing negative treatment consequences, are sufficient to indicate evidence of perceptual curiosity.[3] Such results are additionally compelling because they strongly suggest that perceptual curiosity is a very fundamental attribute of human behavior.

Another type of qualification on the notion of a simple linear relationship between stimulis complexity and curiosity is offered by Dember and Earl (1957). These writers theorize that curiosity behavior, as defined here, will be a joint function of the complexity of the stimulus and the complexity level of the individual who is transacting with that stimulus. An individual's complexity level may be viewed as akin to his level of cognitive functioning, but as noted by Dember and Earl, it is not necessarily fixed. Rather, it may vary over time, e.g., along with experience with stimuli of varying complexity. That is, approach behavior towards stimuli of varying complexity will be dictated or mediated by the individual's complexity level at a given moment in time. For example, a moderately complex stimulus may evoke a curiosity response, while a more extremely complex stimulus might have evoked an aversive response from the same individual at that moment.

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[3] Such effects are not limited to the visual sphere alone as studies by Butterfield (1969) and Siperstein (personal communication) have indicated with reference to the evocative consequences of differentially complex auditory stimulation in neonates.

In some contrast to the foregoing, another view with respect to individual differences in curiosity behavior is roughly drawn in terms of Social Learning Theory (e.g., Rotter, 1954; Cromwell, 1963). In this conceptualization, prior experience in coping with events that are relatively high in informational uncertainty, i.e., complex stimuli, disposes individuals to differentially approach or avoid subsequent events that are high in uncertainty. If an individual has a history of non-reinforcement in his attempts to cope with new (for him) informational contexts, he will generalize that history and project it towards future and similar events, in the form of an expectancy that such future events will be likewise non-reinforcing. And further, since unconsumated involvement with new informational contexts may be accompanied by negative reinforcement, whether intrinsic (e.g., feelings of frustration) or extrinsic (e.g., derision from peers), an expectancy that contending with stimulus complexity leads to noxious outcomes may likewise be developed. In the face of either or both of such expectancies, an individual would actively avoid stimulus complexity in general. Instead, he would seize available opportunities to maintain familiar, non-threatening and non-noxious events in his immediate surroundings. In contrast with the view of Dember and Earl, this individual would display a generalized aversive set towards stimulus complexity that could perhaps be modified only under circumstances where positive reinforcement becomes associated with curiosity behavior on the part of the individual.

Thus, in a social learning-theoretic view, curiosity behavior is seen as part of the general affective system of the learner. Since our assumption is that complex stimuli have become associated with negative affective consequences for some individuals, a necessary prior assumption is that earlier in the history of these individuals, such associations did not obtain. That is, it seems essential to assume that individuals for whom stimulus complexity has become noxious will earlier in their history display interest in complexity, i.e., curiosity towards new informational contexts. Without this assumption, and given the necessary role of curiosity in acquiring information, it would not have been possible for such individuals to have actively learned at all. Similarly, the probably long-term development of negative generalized expectancies with respect to complex stimuli is contended here to be itself a learned effect. If this is indeed the case, it is possible to suggest that such negative expectancies may be reversed or over-ridden by new experiences whereby positive affective consequences are learned to be contingent upon curiosity behavior.

Relatively early histories of difficulty in the management of information, especially in formal learning contexts, should be nowhere in greater evidence than among mentally retarded individuals. This assumption or its variants has led in the past to the hypothesis that mental retardates develop generalized expectancies for failure in new learning situations which lead in turn to debilitating performance effects. That hypothesis has been confirmed by several research findings, either totally or partially (e.g., Heber, 1957; Gardner, 1958;

or see Cromwell, 1963, for a general review of these and related studies). Subsequent research (Bialer, 1960; Miller, 1961; Bialer and Cromwell 1965) has qualified these earlier findings to some extent, i.e., with the notion that cognitive development plays a role in the ability to conceptualize goal accomplishment or non-accomplishment as "success" or "failure", respectively, and with evidence that some retardates predictably respond to failure in specifiable situations with increased effort. What these qualifications provide in the present context is the expectation that relatively more mature and high-functioning mentally retarded individuals should be particularly sensitive to the noxious potential of complex stimuli. Further, because increased effort in the face of failure relatively mature retardates has been found to occur under circumstances where the learner has prior evidence that effort on a similar task has been positively reinforcing (Miller, 1961), there is a basis for expecting that similar individuals would likewise respond to evidence that exploration of complex stimuli can be rewarding.

In further regard to the question of heightened sensitivity to complexity by relatively high-functioning retardates, Hoats, Miller and Spitz (1963) found that higher-IQ institutionalized retarded adolescents were more likely to systematically reject visually complex stimuli than their lower-IQ counterparts. In that same study, Hoats, et al., found that retardates were generally less curious, with respect to choice of visually complex material, than presumably normal-IQ high school students living in the community. However, the study by Hoats and his colleagues did not establish whether similar effects obtained for more typical educable mentally retarded individuals, i.e., those living in the community, nor was it clear that high school students in that study were in the normal IQ range since no assessment was made in this regard. Further, since stimuli in Hoats, et al consisted only of simple-complex dichotomies, the operational definition of curiosity in terms of approach or aversive behavior towards complex stimuli is somewhat compromised. That is, it is possible that some subjects chose simple (symmetrical, congruous, etc.) stimuli because the contrasting stimuli were too extremely complex, but that they would have behaved otherwise with respect to more moderately complex options. The Hoats, et al method, like its predecessors, does not permit a gradation of complexity for given stimulus configurations. An improved methodology would permit complex grading by using at least three members of any given stimulus set or configuration. This would also allow tests of the transitivity of behavior with respect to stimulus complexity, in that one could examine whether subjects who approach or reject stimuli that are of relatively high complexity would behave similarly towards more moderately complex stimuli.

The present project was undertaken in part as an effort to confirm and extend findings in Hoats, et al., but with an eye to taking the above-noted reservations in that study into account. In addition, this

project considered possible correlates of perceptual curiosity as defined here, by examining samples of retarded and normal-IQ subjects on a variety of personality and cognitive measures along with assessment of their responses to visually complex stimuli. Further, this project was concerned with the modifiability of perceptual curiosity in mentally retarded subjects through training, and the possible transfer effects of such training. Finally, our efforts led to exploration of several different methods for studying perceptual curiosity. While these explorations proved somewhat abortive for various technical reasons, they did lead to interesting if somewhat tangential studies which lend additional perspective to the general problems of affective development in normal and retarded individuals.

More specifically, the following hypotheses and/or propositions were examined in this project:

1. Educable-range mentally retarded individuals who live in the general community will on the average show less perceptual curiosity than individuals of like chronological age but with IQ's in the normal range;

2. "Perceptual curiosity" as a trait will be positively related to a class of other variables which may be said to generally characterize an "Information-oriented personality." This is thought to include such variables as: internal locus of control, tolerances for risk and for stimulus ambiguity, achievement motivation, and artistic judgment;

3. When the extent of perceptual curiosity is relatively low in an individual, it can be modified by regarding curiosity behavior as an instrumental act accompanied by appropriate feedback for such instrumental activity;

4. Increased perceptual curiosity behavior through training will lead in turn to behavior which is thought to be concommitant with such activity, including greater persistance in a difficult task, greater responsivity to opportunities for increased information, and greater flexibility in the learning context.

II. General Methodology

A standard method for assessing level of perceptual curiosity was employed in virtually all experiments conducted within this project. There were also some special variants or modifications of the standard method, and some exploratory efforts with alternative assessment techniques which were applied from time to time. These will be noted below, along with reference to expanded descriptions of their application elsewhere in this report.

Subjects: General Comments.

In all studies within this project, subjects were in the adolescent or young adult age range, from about 13 to 21 years old. Mentally retarded subjects were drawn from secondary-level special classes for the educable mentally retarded (EMR) in various public junior and senior high schools in the New York City metropolitan area, including portions of northern New Jersey. Placement in an EMR special class was the only criterion for inclusion in this project as part of the mentally retarded sample. There were no exclusions for reasons of etiology or IQ. Assumedly, the mentally retarded sample included substantial proportions of subjects who had sustained neurological damage at some point in their histories. Also, it is likely that some "EMR" subjects would, on careful psychometric re-examination, show IQ scores above or below the EMR range, i.e., IQ 50-84. Furthermore, there are undoubtedly numbers of adolescent children in the regular classes who could "qualify" for inclusion in a special class for EMR children, but for various and sundry reasons remain in the regular educational system. The definition of "mentally retarded" in this project is therefore both over- and under-restrictive in some respects. Nevertheless, it does reflect the most cogent social factors for an appropriate definition, i.e., some basis for referral for a psychometric evaluation, and a score on an individually administered intelligence test that is between IQ 50 and 84 which is an outcome of that referral.

Most non-retarded subjects were drawn from the junior and senior high schools where EMR classes were sampled. All non-retarded (regular class) subjects were administered Otis intelligence tests, along with other measures, in the classroom setting. On the basis of Otis IQs, it was possible to exclude those subjects who were not in the "normal-IQ" range, i.e., with IQs between 90 and 110. Nevertheless, some subjects with IQs exceeding 110 were run on other measures for some special analyses. In general, however, reference to "normal-IQ" subjects in this project specifies that these subjects were within the 90-110 IQ range, unless otherwise noted.

In addition to non-retarded subjects from junior and senior high schools, some freshmen, sophomores, and juniors from a state college in a northern New Jersey urban area were included in the project. This was done initially because it was anticipated that some students in EMR classes would exceed CA 18, i.e., the usual upper limit in regular public high schools, but it was also of additional general interest to the project. The state college from which samples were derived draws many students from working class families, thus providing an unusual degree of SES comparability with many of the retarded subjects, and also, some atypically low IQs (Otis) for a college sample.

Stimuli.

In the study by Hoats, Miller, and Spitz (1963), five pairs of stimuli for each of six dimensions of complexity were prepared. These 30 stimulus pairs included many originally used by Berlyne (1958), but other pairs were designed and added in order to have five sets in each of the six dimensions, likewise derived from Berlyne. In each pair, one member was more complex than the other. Complexity of a member was defined in terms of one of the six dimensions, as follows:

A. Irregularity of Arrangement. The complex member of the pair showed an irregular or asymetrical arrangement of its elements, while in the simple member, elements were arranged symmetrically.

B. Amount of Material. The complex member of the pair showed more elements than its simple counterpart.

C. Heterogeneity of Elements. The complex member consisted of a variety, or dissimilarity of elements, while its simple counterpart showed a repetition of identical elements.

D. Irregularity of Shape. The complex member showed an asymetrical contour, while its simple counterpart consisted of some regular and symmetrical line figure.

E. Incongruity. In the complex member, an animal of some improbable characteristic(s) was depicted, while its simple counterpart consisted of a relatively commonplace rendition of that animal.

F. Incongruous Juxtaposition. In the complex member, some characteristic(s) of two objects were juxtaposed, while in its simple counterpart, the two objects were presented intact.

In the present project, each stimulus pair used in the Hoats, et al. study was expanded to a triad, in the following manner. For each pair, several additional figures were drawn which were thought to be either more extremely complex than the complex member of a pair used in Hoats, et al., or more moderate in complexity than the Hoats, et al. complex member but still more complex than the original simple member. For some stimulus sets, as many as five additional figures were drawn while no fewer than three additional figures were drawn for any set.

Stimulus sets were then presented to each of 12 judges (graduate students in special education or psychology), who had instructions to order the members of each set according to their complexity, depending on the complexity dimension which was specified and defined to the judges. From these judgments, it was possible to select one additional figure for each set which most consistently was ordered as more extremely complex than a Hoats, et al. complex member, or was midway between simple and complex Hoats et al. pairs. No attempt was made to scale the equivalence of intervals between contiguous members of a set, and it is likely that these varied considerably. Nevertheless, it was possible in this way to develop three-point "continua" of complexity for each stimulus set.

The 30 stimulus sets (triads), arranged by dimension and each in order of complexity from low to high, are presented in Figure 1.

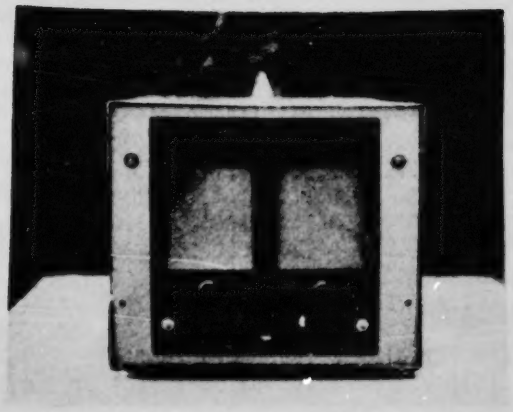
Procedure

In all experiments reported herein, stimuli were presented in pairs, with one member of each pair highly or moderately more complex than its counterpart. If all possible permutations of the 30 stimulus sets were used, a pair could consist of the most complex member vs. the simples member (HI-LO), the most complex vs. the more moderately complex member (HI-MID), or the more moderately complex vs. the simplest member (MID-LO). Stimulus pairs were always oriented horizontally, and left or right position of the complex member was equally divided among pairs, with position of the complex members arranged in a quasi-random sequence across pairs.

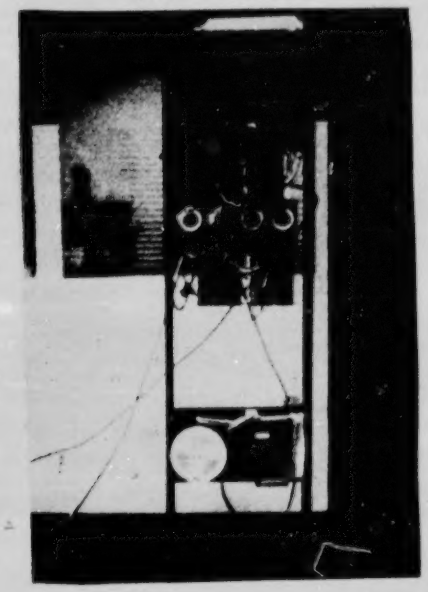
Apparatus.

Stimuli were presented on a modified Foringer Visual Test Module (VTM), which is pictured in Figure 2. With the VTM, each stimulus pair could be automatically presented for a fixed exposure period, then automatically switched off until a subject selected a given member of the pair. In general, initial exposure was for a three-second duration. Subjects sat in front of the VTM, at a distance which permitted simultaneous viewing of both stimuli during any initial exposure period, and with the face of the VTM within easy and comfortable reach by hand. Subjects' choice was executed by depressing one of two buttons, each immediately below the corresponding

Figure 1. The 30 stimulus sets, arranged by dimensions.



visual test module (VTM):
subject's view



experimenter's control
rack and paper tape punch

Figure 2.
Visual Test Module and control rack, used in complexity-choice and training studies.

window, left or right, where the selected member would then reappear virtually immediately. This was accomplished by a split shutter, both of whose sides lifted automatically during the initial exposure of a stimulus pair, but only the corresponding side lifting when the appropriate button was depressed, thus activating the shutter. A selected member stayed in view as long as the subject held the button in. Buttons were modified to be oversized, and therefore relatively comfortable under a subject's finger, and very little effort was required to depress a button fully. Release of the button led to immediate loss of the selected image, and a cycling process of about 2 seconds until the next stimulus pair was initially exposed. Stimulus pairs had been prepared on 35 mm. color transparencies with each member so positioned on the transparency that its image was centered in its corresponding window. Images were large, each filling 50-60% of the window.

Choice of a member, as well as the amount of time between initial exposure and choice (i.e., decision-time or latency), and the amount of time the selected member was held in view by the subject (response-time or duration) were monitored by analogue devices and clocks, and these data were automatically recorded on a Royal paper tape punch. Time data were taken in hundredths of seconds. Stimulus transparencies were so coded as to permit automatic recording of complex or relatively simple choices, as well as the position (left or right) of choices.

In addition to such automatic recording of data, the experimenter kept a pencil-and-paper record of subjects' choices, but not of latency or duration. This recording was done out of a subject's line of vision.[4]

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[4] The decision to duplicate the recording of subjects' choices turned out to be a very fortunate one. Despite repeated and periodic assurances from presumably expert persons that all was in working order, we all too frequently discovered equipment defects and breakdowns, as well as probably avoidable errors in equipment usage by the experimental team. These various mishaps led to enormous losses of useable automatically recorded data throughout the run of the project. Some of these were salvageable. But because of the pencil-and-paper records, we always had data on choices available.

Instructions.

Use of the VTM involved the following introductory instructions to each subject:

"I am going to show you pictures, two at a time here on the screen. I want you to look at both pictures while they are on the screen and decide which one you would like to see some more. The two pictures will go off pretty soon. When the two pictures go off, you can bring back the one you want to see some more by pressing a button. If you want to see the picture on this side (pointing to the left window), press this (left) button. Or, if you want to see the picture on this side (pointing to the right window), press this (right) button. The picture you want to see more of will come on the screen as soon as you press the button. You can look at the one you bring back as long as you want to. It will stay on the screen as long as you keep the button pressed. When you let go of the button, the picture will go off, and two different pictures will come on the screen.

"There are no 'right' or 'wrong' pictures; it depends on what you want to see some more of. You don't have to remember anything about the pictures. Just choose as you wish."

Procedural Variations.

In addition to the procedure described above, several variations were explored, largely for methodological reasons. For one, it was of interest to consider the possible relationship between the forced-choice method for studying curiosity behavior just described, and the more commonly employed fixation-time method, e.g., where a subject is simultaneously shown a relatively complex vs. a less complex figure while his time on each figure is observed and recorded. The comparability of these two methods is of more than idle interest since it is conceivable that the forced-choice method, employed throughout this project, is tapping very different processes than have been studied by the fixation-time approach. On the other hand, it is also plausible that shifts in gaze, e.g., from a less to a more complex figure, are quite analagous to the more gross and molar decision response made by a subject when he rejects a simple figure in favor of a more complex one in the forced-choice technique. Our exploration of the possible relationship between choice and fixation methods is reported in Section IV.

Another methodological question which was explored somewhat in this project concerns the amount of time employed in the initial exposure of a stimulus pair. As noted earlier, our general method employs a three-second initial exposure time. However, Berlyne (1963) has raised a question from findings in Hoats, et al., which also involved a three-second initial exposure period. Berlyne suggests that a three-second exposure is too long a time period to tap what he

calls "specific" curiosity. Rather, Berlyne believes that three seconds permit sufficient time for the subject to make a "diversive" curiosity response, akin to an aesthetic choice, and this is what may account for seemingly lower overall curiosity in both the normal and retarded subjects in the Hoats, et al. data. This argument is supported somewhat by data provided by Berlyne (1963), but the dissimilarity of his method and our own raises questions about the generalizability of his findings. Therefore, possible differences in exposure time were explored somewhat within this project, and the findings pertinent to this are reported in Appendix A.

Finally, because of the availability of apparatus, it was possible to consider an additional method for studying curiosity behavior, i.e., by means of measuring changes in pupillary reflexes as a function of greater or lesser stimulus complexity. The findings of this exploratory study are reported in Appendix B.

III. Perceptual Curiosity Characteristics: Distributions, Item Differences, and Transitivity Effects.

The initial series of experiments in this project were undertaken with the primary objective of developing a set of items which would optimally assess level of perceptual curiosity, i.e., as defined earlier in this report. This objective required that the pool of items from which optimally discriminating ones could be later selected should be administered to subject samples likely to yield considerable inter-subject variability in their overall responses. Since earlier research (Hoats, Miller, and Spitz, 1963) had shown retardates to be relatively homogeneous in their response tendencies vis-a-vis stimulus complexity, only non-retarded subjects were targeted for these immediate objectives.

As noted earlier, stimulus sets from the work of Berlyne and Hoats, et al. were expanded from pairs to triads, yielding miniature continua of low, moderate, and high complex stimuli within each set. It was thus possible to study the transitivity of responses within each such continuum, and ultimately to consider the extent of transitivity for each of the complexity dimensions, and also, across the entire array of dimensions. These were the secondary objectives of the initial experimental series. While it had been originally planned to limit studies of transitivity to non-retarded subjects, it was ultimately possible to administer the full array of stimulus sets to a sample of retarded subjects. This afforded a comparison of retarded and non-retarded subjects' performance in terms of transitivity effects, as well as more general comparisons.

III.1 Distribution of Perceptual Curiosity Characteristics in Non-retarded Adolescents and Young Adults.

Method

Subjects. From a pool of 199 undergraduate student volunteers in special education classes at a college in northern New Jersey, (102 freshmen, 47 sophomores, and 50 juniors), 57 were selected to participate in the first study. Of this group, 29 were female and 28 were male, consistent with a 50-50 sex distribution in nearly all studies within this project. All subjects had been initially administered a battery of pencil-and-paper tests, including Otis Intelligence Scales. The latter measure yielded an IQ range of 98-127. The characteristics of the subsample used in this experiment compared very favorably with the larger pool from which they were drawn in terms of IQ, age, and socio-economic status. However, since there were more females than males in the larger

pool (115 F, 84 M), the representativeness of the subsample was restricted in this regard, i.e., Mean IQ = 113.96, Mean age = 18.5 years, and Mean SES = 4.10 for the subsample, as compared with means of 113.88, 18.6, and 4.07 respectively for the larger pool.

In addition, 48 junior and senior high school students, 12 each from grades 9 through 12, were selected from larger pools that had been pre-tested in regular classes at schools in suburban northern New Jersey. The high school subsample was deliberately restricted in terms of IQ so as to draw a group limited to the normal-IQ range, IQs 90-110. Since the Mean IQ of the high school pool = 114.51, adherance to the aforementioned constraint was difficult, leading to some small violation, i.e., inclusion of a few subjects with IQs between 110 and 115 in the subsample. Mean IQ of the subsample = 105.58, while Mean age = 16.4, and Mean SES = 2.87. These latter two indices compared favorably with those from the larger high school pool (Mean age = 16.3; Mean SES = 2.91).

Stimuli. It has already been noted that stimulus continua were articulated and presented to subjects in pairs, so that a given choice was made for a member of stimulus pairs that were either HI vs. LO, HI vs. MID, or MID vs. LO. The three possible pairings for each continuum were distributed as follows: Each pair appeared as one item in a series of 30 items. Further, each of the six complexity dimensions was represented in any group (or block) of 6 items. Thus, each set of 30 items (or pentablock) consisted of 5 blocks, within which each dimension was represented by one of the 5 stimulus sets included in that dimension, and one of the 3 possible pairings within that set. Any pentablock of 30 items had an equal number of HI-LO, HI-MID, and MID-LO pairs, i.e., 10 of each. Also, in each pentablock, relatively complex stimulus members appeared on the left or the right of a pair an equal number of times. Ordering of representative pairs from dimensions within blocks was quasi-random, with care taken that given dimensions be separated by at least two items between blocks.

Procedure. Each of the 105 subjects was instructed in the use of the VTM as described earlier (see Section II, General Method). The subject was then randomly assigned to one of 3 order conditions, as follows: The 3 pentablocks (I, II, and III), each consisting of 30 items as just described, were sequenced either I-II-II, II-I-II, or II-III-I, in a Latin square, so that each pentablock appeared first, second, or third for an equal number of subjects. There were thus 35 subjects (19 college students, 16 high school students) to each order condition. Administration of the pentablocks was separated by 2-minute rest periods.

Immediately following administration of the 3 pentablocks (90 items in all), subjects were administered two additional measures, one assessing tolerance for ambiguity, and the other designed to assess frustration tolerance. These measures and their effects are discussed in Section VII.

Results and Discussion

The complexity-choice scores of subjects were analyzed in a Lindquist (1953) Latin-square mixed design, with Pentablocks and their Sequencing as the two main effects. Results of this analysis are given in Table 1.

Table 1.

Analysis of Variance for Complexity-Choice By Pentablocks and Pentablock Sequence in Non-Retarded Subjects (N=105).

Source	df	ms	F	F.95	F.99
Between Ss	104	184.35			
AB (b)	2	8.14	<1		
error (b)	102	187.81			
(A) Pentablocks	2	1.38	<1		
(B) Sequence	2	24.31	4.25	2.99	4.60
AB(w)	2	10.48	1.83		
error (w)	204	5.72			

It may be seen on inspection of Table 1 that there were no significant effects for pentablocks and no interactions between pentablocks and sequencing. However, there is a significant main effect for Sequence. This is accounted for by the fact that for all sub-groups, the 3rd pentablock of 30 items showed significantly fewer relatively complex choices. Across all subjects, Mean Complexity Choice for the first, second, and third arrays of 30 items was 15.01, 15.00, and 14.17 respectively. Note that this effect is <u>not</u> a function of specific stimuli, but rather, evidently an effect of time, or concomitantly, exposure to many (90) stimulus pairs. It should also be noted that while these differences in 30-item arrays are reliable, their magnitude is not great.

According to the means for each array of 30 items, subjects are on the average seemingly responding in random fashion to complexity-choice, i.e., within means at or close to 15 out of 30 for each array, and therefore, a 50-50 split over pairs. Does this properly characterize the perceptual curiosity behavior of these subjects? Inspection of Figure 3 shows that it does not. Instead, the distribution of subjects across 90 possible complex choices is bimodal, with approximately equal numbers at either extreme, and a marked trough in the center (around chance levels) of the distribution. Thus, it may most judiciously be concluded that, with respect to the full array of 90 items employed here, non-retarded adolescents and young adults will tend either to systematically select relatively complex stimuli (be "curious"), or select relatively noncomplex stimuli (be "noncurious") with a roughly equal degree of likelihood.

On the basis of the Pentablock X Order analysis, it should be again noted that there tends to be a diminuation of complexity-choice over 90 trials. Whether this effect is equally likely for curious and noncurious subjects remained for subsequent analysis to consider. In this regard, subjects were re-grouped as L-Curious, H-Curious, or Random, depending on their complexity-choice scores out of 90 items, and their scores for their first, second, and third pentablocks (ignoring pentablock specificity) were analyzed. Table 2 gives the pentablock means (out of 30 possible) for each of these three groups. Table 3 summarizes an analysis of variance on these data.

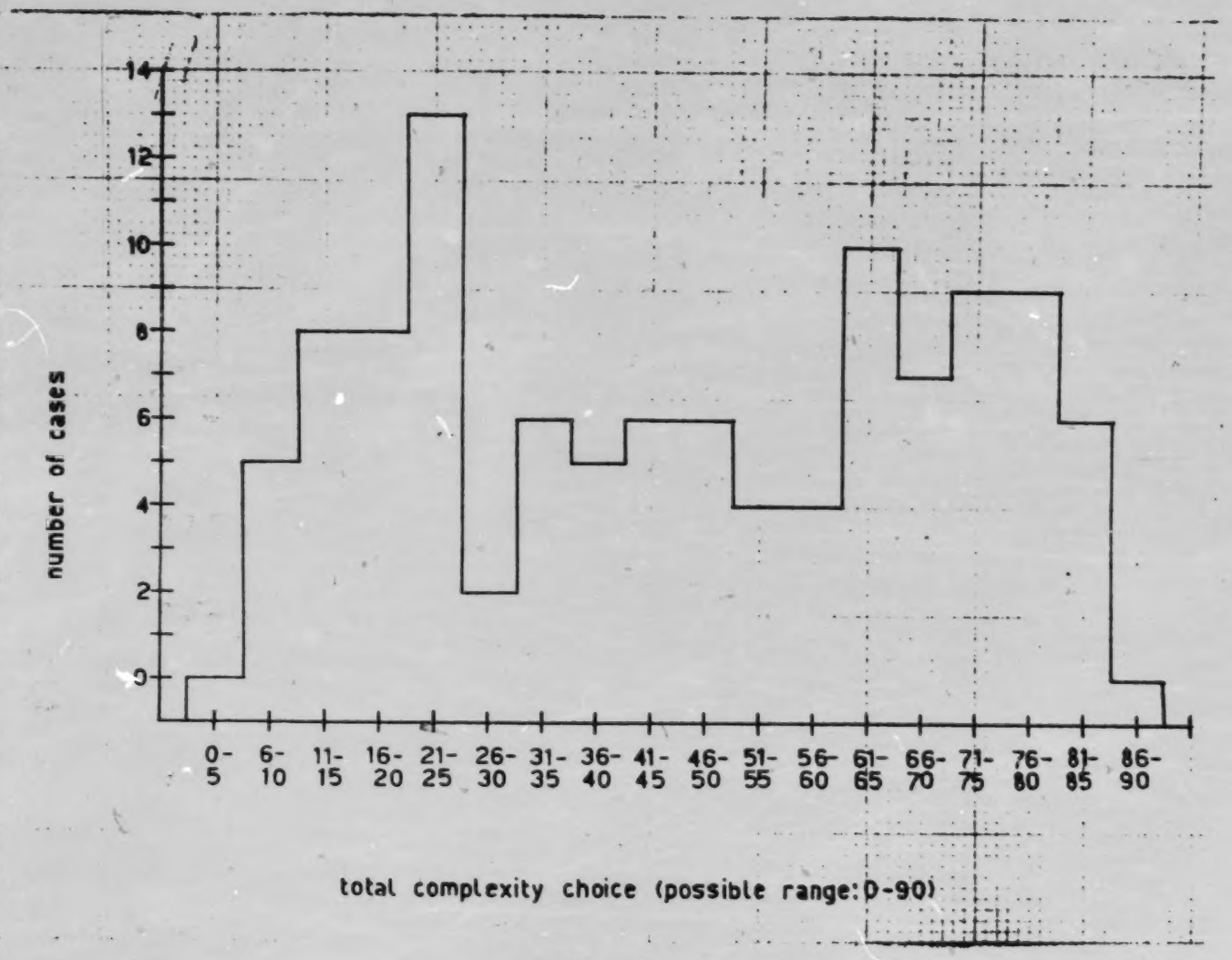


Figure 3.
Distribution of complexity-choice rates for 105 College and Secondary school students.

Table 2

Mean Complexity Choice Per Pentablock, For Hi-Curious, Lo-Curious, and Random-Choice Non-Retarded Subjects

	Group HI	Group LO	Random
Complexity Range	64-84	8-23	24-62
n	30	30	45
First Pentablock	24.63	6.00	14.60
Second Pentablock	24.43	5.03	15.35
Third Pentablock	24.10	5.06	13.62

Table 3

Analysis of Variance of Complexity Choice Per Pentablock Sequence as Function of High, Low, or Random Complexity

CHOICE GROUP

Source	df	ms	F	F.95
Between Ss	104	184.35		
(B) Group	2	8146.29	288.46	3.09
error (b)	102	28.24		
(A) Sequence	2	24.31	4.31	2.99
AB	4	10.44	1.85	2.37
error (w)	204	5.63		

Examination of Tables 2 and 3 reveals that whereas there appear to be differing trends for pentablock sequence in the three groups, all significant variance is accounted for by group membership and by sequence. The first effect is inevitable because of the nature of the grouping variable, while the second is simply a repeat of what was found in the earlier analysis (Table 1.) In any event, the trends suggested in Table 2 show that the significant sequence effect can hardly be explained by shifts in complexity choice by High-Curious subjects, since pentablock averages for this group are relatively stable. Thus, it is possible to rule out a regression effect. Rather changes in Low-Curious and Random

subjects appear to explain the decline over sequencing, but again, not to an appropriate confidence level. Failure to find a significant AB interaction cannot be attributed to the Random group cancelling out a differential sequence effect for High-and Low-Curious groups, since an analysis of variance on data for these latter groups alone shows a clearly nonsignificant interaction ($F < 1.00$).

Summary

One hundred and five college and high school students were run on 90 complexity choice pairs, one third of which were HI-LO complex pairs, one third HI-MID pairs, and one third MID-LO pairs. Pairs were grouped into 30-item arrays, and these arrays were varied in 3 different order conditions. Results showed a general bimodal distribution of subjects with about equal numbers concentrated at either extreme of the distribution. A significant sequence effect, showing a general decline in complexity choice over arrays, could not be attributed to general level of curiosity, although differing trends for curiosity level were noted.

III. 2. Development of 30-Item "Short" Technique

In the original plan for this project, it was intended that studies involving retardates would make use of a 30-item technique for assessing level of curiosity. This approach was dictated not only for the obvious economy advantages, but also to maximize similarities in approach between these studies and earlier ones which were taken as points of departure, e.g., Hoats, et al. (1963). Furthermore, the applicability of the 90-item approach just reported to retardates was uncertain, e.g., it was felt that the high concentration of marginally differentiated pairs (HI-MID and MID-LO) could create a set for random choice in retardates.

Method

Individual item data was prepared for the 30 High-Curious and 30 Low-Curious subjects involved in the study reported above (III.1.) For each item, the frequencies of High-Curious and Low-Curious subjects who selected the more or the less complex pair member were compared, and these frequencies were analyzed by $\underline{X}^2$. The objective was to select one pair from the three pairs per stimulus set which discriminated best between High- and Low- curious subjects. The magnitude of $\underline{X}^2$ was taken as the criterion for item selection.

Results

Frequencies of High- and Low- curious groups who selected more and less complex members per stimulus pair, along with the corresponding $\underline{X}^2$ values, are given in Table 4.

Table 4.

Frequencies of Choice of More Complex Stimulus Per Pair For High- and Low- Curious Groups. (n=30 In Each Group)

DIMENSION	STIMULUS SET	GROUP	TYPE OF PAIR					
			HI-LO	X^2	HI-MID	X^2	MID-LO	X^2
A: Irreg. of Arrangement	A1	HIGH	30	*42.4	22	.3	22	31.6
		LOW	4		20		0	
	A2	HIGH	30	*48.8	25	7.3	22	15.1
		LOW	2		14		6	
	A3	HIGH	27	*50.1	14	4.8	24	26.8
		LOW	0		6		4	
	A4	HIGH	30	*48.8	19	5.5	19	18.8
		LOW	2		10		2	
	A5	HIGH	25	*32.6	16	19.2	27	11.9
		LOW	2		0		14	
B: Amount of Material	B1	HIGH	14	2.6	29	*31.1	14	-4.4
		LOW	8		8		22	
	B2	HIGH	30	21.0	30	*39.2	26	6.4
		LOW	13		7		16	
	B3	HIGH	27	1.8	24	*26.8	22	.3
		LOW	22		11		20	
	B4	HIGH	26	5.2	30	4.6	29	*30.6
		LOW	17		24		7	
	B5	HIGH	30	15.7	29	*41.8	24	.8
		LOW	16		3		21	

DIMENSION	STIMULUS SET	GROUP	TYPE OF PAIR					
			HI-LO	X^2	HI-MID	X^2	MID-LO	X^2
C: Heterogen. of Elements	C1	HIGH	27	*22.2	24	29.9	27	18.0
		LOW	8		2		10	
	C2	HIGH	27	*18.0	25	19.5	22	9.8
		LOW	10		8		10	
	C3	HIGH	27	*38.4	22	6.8	30	42.4
		LOW	2		12		4	
	C4	HIGH	30	*42.4	25	4.0	25	8.9
		LOW	4		18		14	
	C5	HIGH	24	21.6	19	11.6	*19	24.9
		LOW	6		6		0	
D: Irreg. of Design	D1	HIGH	22	*25.1	27	10.0	11	6.3
		LOW	2		14		2	
	D2	HIGH	27	26.9	22	13.1	27	*38.4
		LOW	6		8		2	
	D3	HIGH	22	31.6	25	24.1	27	*38.4
		LOW	0		6		2	
	D4	HIGH	30	*48.8	19	5.4	25	32.6
		LOW	2		10		2	
	D5	HIGH	26	*24.2	27	8.2	23	19.3
		LOW	6		16		6	

DIMENSION	STIMULUS SET	GROUP	TYPE OF PAIR					
			HI-LO	X^2	HI-MID	X^2	MID-LO	X^2
E: Incongruity	E1	HIGH	22	19.6	16	7.2	19	*24.9
		LOW	4		6		0	
	E2	HIGH	27	*50.1	19	3.3	14	15.7
		LOW	0		12		0	
	E3	HIGH	17	*21.0	22	9.8	8	.9
		LOW	0		10		4	
	E4	HIGH	16	15.6	5	.6	15	*17.4
		LOW	2		2		0	
	E5	HIGH	27	*38.4	8	0.0	16	15.6
		LOW	2		8		2	
F: Incongruous Juxtaposition	F1	HIGH	27	22.2	16	2.4	26	*24.2
		LOW	8		10		6	
	F2	HIGH	22	*25.1	24	24.2	19	13.8
		LOW	2		6		4	
	F3	HIGH	24	*29.9	22	6.8	15	17.42
		LOW	2		12		0	
	F4	HIGH	21	* 5.45	8	3.2	17	1.7
		LOW	12		14		12	
	F5	HIGH	24	*36.7	27	38.4	16	2.4
		LOW	0		2		10	

In Table 4, asterisked items are those selected for the 30-item best-discriminating series of pairs. A few comments are in order. In several instances, most notably with reference to pairs in Dimensions C, Heterogeneity of Elements, the best-discriminating pair of a set was rejected in favor of a next-best discriminator, because the integrity of the dimension would otherwise be compromised. For example, in Set C1, the HI-MID pairing yielded a higher $\underline{X^2}$ than the HI-LO pairing, but the latter item was selected because both members of the former pair show heterogeneity of elements thus limiting the contrast in terms of this dimension. Selection of items in C2, C3, and F5 were similarly compromised.

It can also be noted that while all pairs selected for the 30-item series significantly discriminate between High- and Low-Curious groups, the magnitude of effect in one instance, at least, (F4) is marginal. Furthermore, in 2 of the 5 stimulus sets in Dimension B, Amount of Material, the HI-LO contrast pair failed to significantly discriminate between the High- and Low-Curious groups. This is notable because these are the only HI-LO pairs failing to discriminate adequately.

Summary

An item analysis of 90 items, comparing a group who was High in rate of choice for complex stimuli vs. a group who showed a low rate of complex choices, yielded varying levels of discriminability across items. A 30-item "short" version of the complexity-choice technique was developed on the basis of best-discriminating items within stimulus sets.

III. 3. Comparison of Retardates and Normals for Distribution and Transitivity Effects.

Is perceptual curiosity, as expressed in rate of choice for complex stimuli, a systematic phenomenon, or does this operational approach to assessment of perceptual curiosity lead essentially to random or biased findings? And, if the phenomenon as considered here is systematic, to what extent is complexity choice affected by thresholds for complexity tolerance? In this latter regard, Dember and Earl (1957) have theorized that approach or avoidance behavior with respect to complex stimuli is mediated by a subject's current level for tolerating different degrees of complexity. In contrast, the contention here is that subjects' complexity-choice behavior will tend towards consistency, especially in the case of subjects for whom complexity is thought to be generally noxious, e.g., mental retardates.

The present study was undertaken to consider the foregoing questions, in the context of a comparison of mentally retarded and non-retarded subjects across the 90-item stimulus complexity series described earlier. In addition, an opportunity was provided to examine perceptual curiosity behavior of retardates in a similar manner to that just reported for non-retarded groups. The consistency of complexity-choice behavior was examined in terms of relative choice rate of moderately complex stimuli as contrasted with rate for more highly complex stimuli. In general, it was hypothesized that complexity-choice would be transitive, i.e., subjects would be likely to systematically select or reject moderate as well as high complex stimuli.

Method

Subjects. In addition to non-retarded subjects from whom data were acquired in Experiment III.1, 36 adolescent retardates, 19 females and 17 males, were involved in the present study. Their ages ranged from 15.8 to 19.3 years, with a Mean CA of 17.6 years. All were students in secondary-level classes for educable-range mentally retarded children, and all were participating in a two-week pre-vocational training program. It is reasonable to assume that IQs for the retarded group were in the EMR range, i.e., 50-75 IQ, considering their placement. Actual IQ test scores were unavailable and further, were not deemed necessary for the conduct of this experiment.

Procedure. Retarded subjects were instructed and processed over a 90-item series in the same manner followed for non-retarded subjects in Experiment III.1. However, a revised order of stimuli, based in part upon the outcome of item analyses conducted in III.2, was used for retardates. In particular, the first block of 6 pairs consisted of one pair from each dimension which was the most highly discriminating between High- and Low-Complex subjects in Experiment III.2. This was done in order to test the extent to which complexity-choice in the first block could be used in predicting choice on subsequent stimuli, an important consideration for later experiments on curiosity training in this project (see Section VIII). In other respects, the order of stimuli employed for retardates had similar characteristics to those used with non-retarded subjects.

Results and Discussion

Retardate Data. Data for each of three pentablocks for retarded subjects were cast in an analysis of variance design which also considered possible sex differences. The results of this analysis are shown in Table 5.

Table 5.

Analysis of Variance of Retardates' Complexity Choice, by Sex and Pentablock. (N=36)

Source	dg	ms	F	F.95
Between Ss	35	88.78		
Sex (B)	1	87.79	<1	
error (b)	34	88.80		
Pentablocks (A)	2	4.74	<1	
AB	2	4.50	<1	
error (s)	68	6.75		

The results in Table 5 show clearly that there is no effect of either sex or pentablocks among retardates. In contrast to non-retarded subjects' performance over pentablocks, there is no significant change over time shown in this analysis. Means for complexity-choice out of 30 possible for pentablocks, I, II, and III were 11.05, 11.75, and 11.58 respectively. Mean choice rate over all 90 items was 34.38.

Table 6 gives the distribution of 36 retarded subjects over 90 items.

Table 6.

Distribution of Retardates' Complexity-Choice Scores (N=36)

Score	Frequency
11-20	10
21-30	10
31-40	4
41-50	6
51-60	4
61-70	1
71-80	1

Inspection of Table 6 shows a clear positive skew in the distribution over items for retardates. These results are

generally consistent with those found by Hoats, Miller, and Spitz (1963) in their studies of institutionalized retarded adolescents. Notably, a few subjects do show relatively high complexity-choice rates. Nevertheless, the distribution characteristics for retardates is in striking contrast with the bi-modal effect shown by high school and college students (see Figure 3.) It should be evident that an item analysis comparing high- and low-scoring retarded subjects in a manner similar to that performed in Experiment III.2 would be meaningless, in view of the paucity of high-scoring retarded subjects.

Retarded-Non-retarded Comparisons: Test of Alternate Hypotheses.

Complexity-choice rates for retarded and non-retarded subjects were compared over all items, and various subsets of items, after that following preparation. For each subject, choice rates were distributed in a 2 x 2 matrix, with complex vs. simple choices as the two points on one axis, and left vs. right choices as the two points on the other axis. The distributions in each such matrix were considered against each of the following hypotheses:

H(a). Systematic choice of complex stimuli;
H(b). Systematic choice of simple stimuli;
H(c). Systematic choice of stimuli appearing on the left side of pairs;
H(d). Systematic choice of stimuli appearing on the right side of pairs;
H(e). Interaction, with consistent choice of complex or simple stimuli only when positioned on the left;
H(f). Interaction, with choice of complex or simple stimuli only when positioned on the right;
H(g). Random choice, i.e., absence of fit to any of the preceeding hypotheses.

An idealized distribution consonant with each of the foregoing hypotheses was created, and the actual distribution of a subject was tested against these idealized distributions. For example, the idealized distribution for all 90 items on H(a), systematic complexity choice, showed 45 choices each for complext members appearing on the left and on the right. A subject's actual distribution was tested against the hypothesized distribution by computing the difference between actual and ideal frequencies in each of the four cells of the 2 x 2 matrix, then summing these differences over the four cells. Furthermore, the actual distribution was compared with each idealized distribution by means of a $\underline{X}^2$. Trends could be noted as to which of the seven difference comparisons yielded the least departure from any idealized distribution, as well as which departures, if any, were significant in terms of $\underline{X}^2$. Obviously, failure to depart significantly from any idealized distribution was construed as support for a given hypothesis.

For 90 items, 58 or more consistent choices, whether complex, simple, left, or right, for any subject yields a $\underline{X}^2$ which is significant at or beyond the .05 level. Such consistency could be reflective of an interaction of some sort between pair membership and position H(e) and H(f), but in no case did a subject show an actual distribution that could be construed as supportive of either H(e) or H(f). In fact, with respect to data over all 90 items, subjects' actual distributions turned out to be consistent with one of only three hypotheses: H(a), complex choice; H(b), simple choice, or H(g), random choice.

Actual 2 x 2 distributions for 36 retarded, 48 high school, and 46 college subjects (randomly selected from among the 57 subjects in III.1 and III.2), over 90 items were classified as complex, simple, or random. That is, subjects with 58 or more complex choices out of 90 were classified as complex, subjects with 58 or more simple choices (or conversely, 32 or fewer complex choices) out of 90 were classified as simple, and subjects with between 33 and 57 complex choices were classified as random. The frequencies of subjects so classified for each of the three major groups were compared by $\underline{X}^2$. These frequencies, their corresponding proportions within groups, and the resulting $\underline{X}^2$, are shown in Table 7.

Table 7.

Frequencies of Retarded, High School, and College Subjects Classified as Complex, Random, or Simple over 90-Item Series.

	Classification			
Group	Complex	Random	Simple	Totals
MR	3 (.083)	13 (.361)	20 (.555)	36 (1.000)
HS	14 (.270)	15 (.333)	19 (.395)	48 (1.000)
COLL.	24 (.521)	12 (.260)	10 (.217)	46 (1.000)

$\underline{X}^2 = 23.26$, $\underline{df} = 4$

$P < .001$

Comparison of classification frequencies for the 3 groups in Table 7 yields a highly reliable $\underline{X}^2$, suggesting differences in classifications for the groups. Breakdowns of these comparisons, two groups at a time, shows that the differences between MR and each of the other groups are significant at or beyond the .05 level (HS vs. MR comparison yields $\underline{X}^2 = 7.01$ $p < .05$, and College vs. MR yields $\underline{X}^2 = 18.86$, $p < .001$.) The comparison of the HS and College groups yields $\underline{X}^2 = 5.78$, for which $.10 < p > .05$.

With respect to these findings, it is notable that close to the same proportion of subjects in the three groups are best characterized as random, with no significant differences between groups when frequencies are distributed as random vs. non-random, while differences between the groups are best explained by the distribution of subjects as complex or simple. In that regard, the sharpest distinction is between MR and College groups, and while differences between Hs and College groups do not reach significance at the .05 level, a majority of College subjects are classifiable as complex, contrasted with only 27% of HS subjects so classifiable.

In Experiments III.1 and III.2, HS and College subjects were treated homogeneously as a "non-retarded" group. The bimodal distribution shown in Figure 3 in effect masks the tendency towards differentiation between the College and HS groups; College subjects appear to contribute the larger percentage at the upper (complex) end of the distribution, while the opposite tends to be true for the HS group. Such findings help explain differences in results for non-retarded subjects in studies by Berlyne (1957) and Hoats, et. al. (1963). In the former study, subjects were found to fixate significantly longer on a complex member in all stimulus pairs. In the latter study, while non-retarded subjects chose complex stimuli more often than did retardates, their choice-rate on the average was nevertheless significantly fewer than a majority of possible complex choices. Berlyne's subjects were students at a highly selective university, while non-retarded subjects in Hoats, et al., were public high school students. The present findings are roughly consistent with the differences between the results of those studies.

Comparisons of Groups by Type of Pairing. In addition to analysis of classifications of the groups over the 90-item series, just reported, it was possible to examine differences between group distributions for each type of pairing; HI-LO, HI-MID, and MID-LO. This represents a partial test of the transitivity hypothesis in that it provides the opportunity to see if differences in group distribution follow the same patterns in different types of pairings.

There were 30 items for each type of pairing. For 30 items, 23 or more of a particular classification (complex, simple, left, right, etc.) are significant beyond the .05 level. As was the case for the 90-item series, subjects were classified according to their best fit to one of the alternate hypotheses described earlier, but now for each type of pairing. Tables 8, 9, and 10 give the distributions for the three groups over classifications. These include a fourth category, Position Bias, since a few subjects showed best-fit to a right- or left-preference hypothesis for specific types of pairings. (Evidently, position bias washed out over the full range of 90 items.)

Table 8.

Frequencies of Retarded, High School, and College Subjects Classified as Complex, Random, Simple, or Position-Biased Over 30 HI-LO Pairs

	Classification			
Group	Complex	Random	Simple	Position Bias
MR	2 (.055)	14 (.388)	19 (.527)	1 (.027)
HS	8 (.167)	23 (.479)	16 (.333)	1 (.020)
COLL.	19 (.413)	16 (.347)	11 (.239)	0 (.000)

$\underline{X}^2 = 19.09$, $\underline{df} = 6$

$p < .001$

Table 9.

Frequencies of Retarded, High School and College Subjects Classified as Complex, Random, Simple, or Position-Biased Over 30 HI-MID Pairs.

	Classification			
Group	Complex	Random	Simple	Position Bias
MR	1 (.027)	22 (.611)	10 (.277)	3 (.083)
HS	8 (.167)	31 (.746)	8 (.167)	1 (.020)
COLL.	17 (.369)	25 (.543)	4 (.086)	0 (.000)

$\underline{X}^2 = 27.66$, $\underline{df} = 6$

$p < .001$

Table 10.

Frequencies of Retarded, High School, and College Subjects Classified as Complex, Random, Simple, or Position Biased Over 30 MID-LO Pairs.

	Classification			
Group	Complex	Random	Simple	Position Bias
MR	2 (.055)	11 (.305)	21 (.583)	2 (.055)
HS	10 (.208)	24 (.500)	14 (.291)	0 (.000)
COLL.	22 (.478)	13 (.282)	11 (.239)	0 (.000)

$\underline{X}^2 = 30.75$, $\underline{df} = 6$

$p < .001$

In the case of each type of pairing, there are significant differences between group distributions beyond the .001 level. Compared with Table 7, there are higher proportions of random-classified subjects for the various types of pairings shown in Tables 8 through 10, and this effect is accentuated in Table 9 (HI-MID pairs). While visual inspection of Table 9 suggests possible differences between groups in random classification, comparison of random vs. non-random classification reveals no significant differences between group proportions on that dichotomy from the data in Table 9. Similar results obtain for data in Tables 8 and 10.

The relatively high proportions of random classifications thus reflected for all groups in type-of-pairing analyses needs explanation. For one, the criterion of 23 or more out of 30 consistent choices for significance in a directional classification is quite stringent, more than is the case for .05 level significance of consistency among 90 items (58 out of 90). Furthermore, with HI-MID pairings, a majority of subjects in all groups tended to respond randomly, with less apparent regard for the degree of complexity (extreme or moderate) than is shown towards HI-LO or MID-LO pairings. Nevertheless, all three groups show trends with HI-MID pairings that are consistent with those shown for the other two types. When for each group, types of pairings are compared (HI-LO vs. HI-MID vs. MID-LO), no $\underline{X}^2$ is significant at the .05 level.

This latter finding is pertinent to a test of the Dember and Earl theory, since an extrapolation of that theory to the present context should lead to an expectation that MID-LO pairings will yield more complex choices than HI-LO pairings. That is, if it is reasonable to expect variable thresholds for complexity in different subjects, it should follow that some subjects would be more taken by a moderate than by an extreme degree of complexity. The analyses just reported do not support the Dember and Earl position, although there is a shift of 5 subjects in the combined non-retarded groups from random classification in HI-LO pairings to complex classification in MID-LO pairings. Rather, these data essentially support an all-or-none view, where subjects are inclined towards consistency in their orientation towards or away from stimulus complexity, i.e., given that their orientation is a systematic one.

Weighted Scores. Another approach to analysis for transitivity with these data is provided if each of the 30 sets (or triads) is assigned a weighted score, as follows. Letting the degree of complexity (extreme or moderate) guide the weight of the score, choice of the complex member in a HI-LO pair = 3, choice of the complex member in a MID-LO pair = 2, while choice of the more complex member in a HI-MID pair = 1. Let the choice of a less complex

member always = 0. If choice is strongly positively transitive, i.e., HI > LO, MID > LO, and HI > MID, the total weighted score for a set = 6. Strong negative transitivity = 0. Moderate transitivity would be represented by a total score of 5 or 1 for a set, depending on the directionality of choice. Weak transitivity would be represented by 4 or 2. A total score of 3 for a set could occur either of two ways: HI > LO, but MID > HI and LO > MID, or LO > HI, but HI > MID and MID > LO. In either such case, a total weighted score of 3 could be said to indicate a selection process by the subject where each of the three members of a set has been selected and presumably examined. This is of course different than systematic directionality of choice, and in terms of transitivity, would be considered random. However, it can be construed as quite systematic.

An initial analysis of weighted scores considered data for the MR and HS groups. An analysis of variance by group and for the 6 complexity dimensions was performed, taking sums of weighted scores across sets within each dimension as the basic datum. The results of this analysis are summarized in Table 11.

Table 11.

Analysis of Variance on Retarded and High School Subjects For Transitivity Scores By Complexity Dimension

(TOTAL N= 84)

Source	df	ms	F	F.95
Ss	83	184.49		
Group (B)	1	553.72	3.07	3.96
error (b)	82	179.99		
Dimensions (A)	5	1557.44	72.10	2.21
AB	5	55.37	2.56	2.21
error (w)	410	21.60		

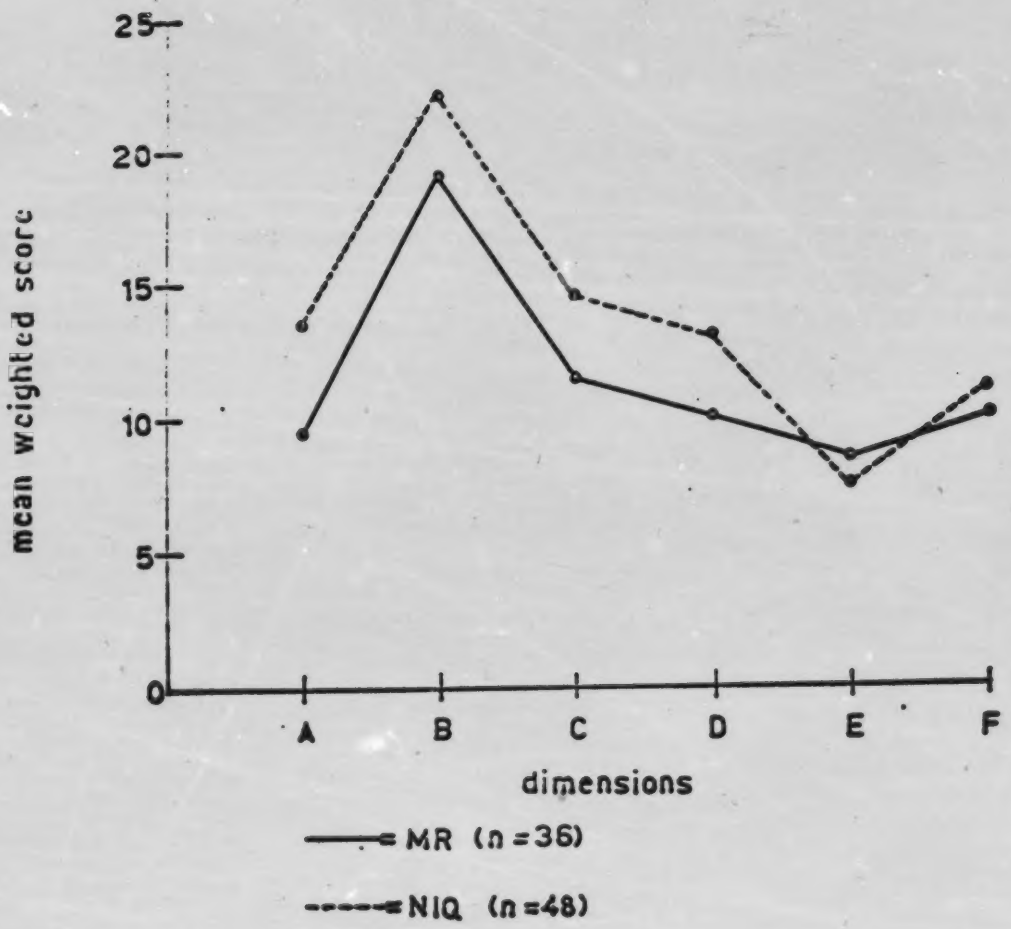


Figure 4.
Mean weighted (transitivity) scores per dimension for MR and HS groups.

Despite the highly significant main effect for dimensions reported in Table 11, the significant group X dimension interaction terms necessitated scrutiny of the data for differential contrast effects between the groups per dimension. Mean transitivity scores for the groups for each dimension are plotted in Figure 4. Comparison of group per dimension by t-test reveals that the HS group significantly exceeded retardates in the magnitude of their transitivity scores for Dimensions A through D (Irregularity of Arrangement, Amount of Material, Heterogeneity of Elements, and Irregularity of Design), but the groups did not differ on Dimensions E (Incongruity) or F (Incongruous Juxtaposition). Further, although the groups differ significantly for B, Amount of Material, the magnitude of mean transitivity scores for both groups on this dimension alone clearly exceeds those for the other dimensions. In fact, it is the only dimension for which average weighted scores per set (value plotted in Figure 4 are averages per dimension) are weakly but positively transitive. Thus, in general, both retarded and non-retarded groups tend to select more complex figures on the average for Amount of Material.

There are two reasonable and competitive, if temporarily moot interpretations of this finding. One would hold that Amount of Material, at least as operationally expressed in these studies, is an inadequate or inappropriate dimension for inclusion in the general assessment of level of perceptual curiosity. The competing interpretation would hold that Amount of Material alone or above all is appropriate for studying perceptual curiosity, and that therefore, subjects regardless of ability share in common an orientation toward stimulus complexity. Needless to add, this latter interpretation is entirely discrepant with the central thesis of this project, which is that there are individual differences in perceptual curiosity leading in one extreme to a generalized aversion with respect to complex stimuli deriving from prior histories of failure to cope with stimulus complexity.

Partial reconciliation of these results is accomplished with examination of intercorrelations between dimensions, as well as intercorrelation of stimulus sets with other sets within a given dimension. Table 12 gives intercorrelations between dimension for each of the groups, with Pearson r values for HS students above the diagonal, and those for retardates below the diagonal.

Table 12.

Intercorrelations of Weighted Scores For Dimensions in High School and MR Subjects*

	A	B	C	D	E	F
A	___	.220	.752	.772	.684	.642
B	.021	___	.337	.248	.088	.172
C	.638	.408	___	.783	.592	.596
D	.658	.228	.699	___	.694	.536
E	.634	.260	.682	.668	___	.645
F	.679	.144	.658	.642	.774	___

*HS above diagonal, MR below diagonal

Inspection of Table 12 reveals that B, Amount of Material, shares considerably less variance in common with other dimensions than do the others in turn. Only one correlation for B, that with Dimension C, Heterogeneity of Elements, is significant beyond the .05 level for both HS and MR groups. At that, these two dimensions share between 10 and 16% of common variance.

Further scrutiny of the differential contribution of the various dimensions to the overall measure is summarized in Tables 13 and 14. Table 13 gives correlations of sets with the sum of all other sets within its dimension, as well as the correlation of a summed dimension score with the total of all other dimension scores, for HS subjects. Table 14 provides similar data for MR subjects.

Table 13.

Intercorrelations of Weighted Set Scores With Total For Other Sets Within Dimensions, And Of Dimension Scores With Total of Other Dimensions, In High School Subjects (N=48)

	DIMENSION					
SET	A	B	C	D	E	F
1	.630	-.007	.669	.702	.528	.515
2	.583	.102	.559	.725	.508	.494
3	.566	.296	.648	.582	.577	.527
4	.680	.125	.463	.708	.516	.290
5	.367	-.002	.605	.576	.544	.628
ALL OTHER DIMENSIONS	.838	.258	.820	.817	.725	.665

Table 14.

Intercorrelations of Weighted Set Scores With Total For Other Sets Within Dimensions, And Of Dimension Scores With Total of Other Dimensions, in MR Subjects (N=36)

	DIMENSION					
SET	A	B	C	D	E	F
1	.512	-.021	.631	.597	.610	.487
2	.457	.316	.541	.468	.663	.730
3	.366	-.459	.165	.390	.493	.717
4	.544	.305	.604	.771	.629	.508
5	.549	.264	.272	.477	.449	.364
ALL OTHER DIMENSIONS	.735	.193	.708	.688	.689	.772

The intercorrelations for sets with dimensions, and for dimensions with all other dimensions combined, in both the HS and MR groups show that B, Amount of Material is least related to other aspects of the technique. In fact, set 3 in B is significantly negatively correlated with all other sets within B! Dimension B alone is not significantly correlated with all other dimensions combined, in both HS and MR metrices. While there is considerable variability in shared variance for sets within some other dimensions, it is clear that sets within B, as well as Dimension B taken as a whole against other dimensions, are generally unrelated.

Therefore, we can conclude that, with respect to the operational definition of perceptual curiosity offered in these studies, Amount of Material apparently does not tap the same attributes as do the other dimensions. This is consistent with the post hoc notion that Amount of Material is an inappropriate dimension for assessment of perceptual curiosity. The alternate interpretation, that Amount of Material is most adequate for perceptual curiosity assessment, is rhetorical in the absence of empirical validation.

Reflected Weighted Scores. While MR and HS groups were shown to differ with respect to transitivity scores per certain dimensions (Table 11), that analysis treated data scored in the direction of positive transitivity. It is unclear whether MR and HS subjects are equally or differentially systematic in their responses within sets. For example, a subject with an extremely low weighted score, e.g., 0, could cancel out a subject with an extremely high weighted score, e.g., 6, so that the net effect would be random choice (or a weighted average of 3' for these two subjects).

In order to examine the differential systematization of response in the two groups, the directional effects of weighted scores were eliminated, as follows. Strong transitivity scores (0 or 6) were all scored 0, moderate transitivity scores (1 or 5) were all scored 1, weak transitivity scores (2 or 4) were all scored 2, while "random" scores of 3 were unaltered. Data based on these reflected weighted scores were then case in an analysis of variance similar to that summarized in Table 11, with groups and dimensions as the main variables. The results of this analysis are summarized in Table 15.

Table 15

Analysis of Variance of Retarded and High School Subjects For Reflected Transitivity Scores by Complexity Dimension (TOTAL N=84)

Source	df	ms	F	F.95	F.99
Ss	83	36.24			
Group (B)	1	.90	<1		
error (b)	82	36.67			
Dimensions (A)	5	52.27	3.83	2.21	3.02
AB	5	21.92	1.60	2.21	3.02
error (w)	410	13.62			

In contrast to findings with respect to unreflected transitivity data (Table 11), Table 15 shows that there is no effect for groups and no group X dimension interaction for reflected transitivity scores. The effect for dimensions, however, is significant beyond the .01 level. Reflected transitivity means per dimension for the two groups are depicted on Figure 5. As noted, apparent differences between groups are not significant. Simple effect analyses comparing dimensions for data from both groups combined shows that Dimension E, Incongruity, yields significantly lower reflected transitivity on the average than each of the other dimensions. The means reflected transitivity for sets in E = 1.28, close to our criterion for moderate transitivity. Means per set for Dimensions A, B, C, D, and F are 1.64, 1.72, 1.69, 1.54, and 1.56 respectively, all tending towards weak transitivity.

Most notable about the findings summarized in Table 15, however, is that retarded and non-retarded subjects are equally systematic in their responses to the various subsets. That is to say, irrespective of the direction of responding, retardates are no less systematic in their decision behavior with respect to choice of complex stimuli than are essentially normal-IQ high school students.

Supplementary Retardate Analyses. Data for retarded subjects were additionally examined for the reliability of various item aggregates,

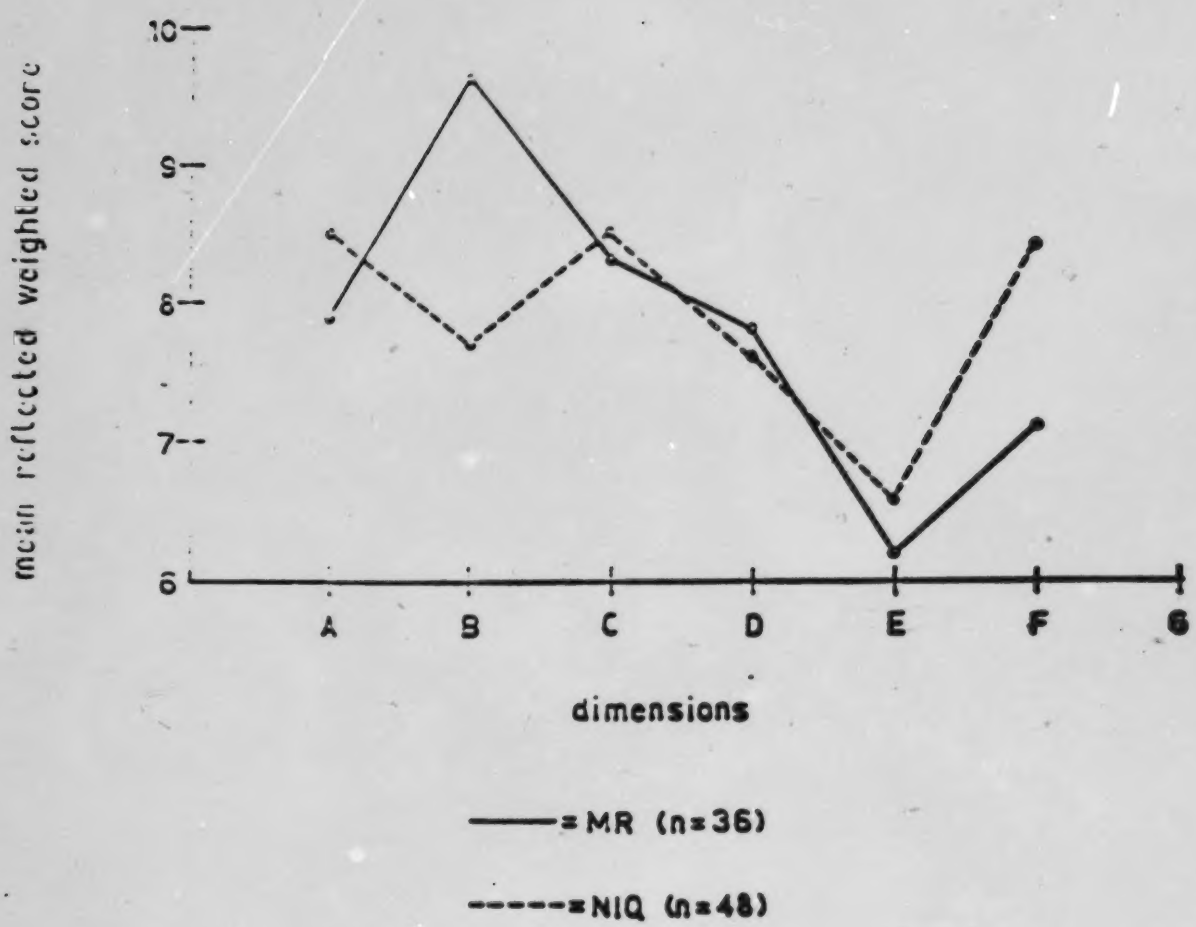


Figure 5.
Mean reflected transitivity scores per dimension for MR and HS groups.

and for the intercorrelation between the first six trials and all other trials. Reliability analyses were undertaken to evaluate consistency of the various aggregates examined. The correlation between the first six vs. the other trials was run in order to consider whether the first six items are sufficiently predictive of subsequent complexity-choice performance. This analysis was necessary because later stages of the project required assignment of subjects to a program for training complexity-choice, and performance on the first six trials was considered a possible basis for such assignment.

Table 16 gives alpha coefficients for each of the six dimensions, the 30-item "short" series developed in Experiment III.2, and the complete 90-item series.

Table 16

Reliability (ALPHA) Coefficients for Various Groupings Of Data From Retarded Subjects.

Grouping	α
Dimension A	.714
Dimension B	.478
Dimension C	.736
Dimension D	.820
Dimension E	.851
Dimension F	.807
30-item series	.868
90-item series	.939

Generally, these coefficients are consistent with findings in earlier analyses. Dimension B (Amount of Material) shows rather weak reliability, while those for the other dimensions are fairly good. The substantial coefficient for the 30-item series tends to confirm the basis of selection for these items in III.2. Above all, the coefficient of .939 for the complete 90-item series supports our notion of general consistency in complexity-choice behavior.

The reliability coefficient (r_{ab}) for the first 6 vs. the other 84 trials = .696. From the standpoint of efficiency of prediction, this degree of relationship is not very good. However, scrutiny of scores for the first six trials against scores for subsequent trials shows that, of the 21 subjects choosing 0, 1 or 2 complex members among the first 6 trials, 17 subjects (81%) could ultimately be classified as simple (i.e., total scores of 32 or less), and the other 4 subjects could be classified as random. Of 7 subjects who chose 3 complex members among the first 6 trials, all but one could ultimately be classified as random. Of 8 subjects who chose 4 or 5 complex members among the first 6 trials, 3 were ultimately classifiable as complex, 3 as random, and 2 as simple. In no case did a subject with 3 or fewer complex choices in the first 6 trials merit classification as complex. Therefore, it was concluded that scores of 3 or less among the first 6 trials could be used as a sufficient basis to assign subjects for complexity-choice training, in that there was very low probability that performance over subsequent trials would merit complex classification in the absence of training conditions.

Summary

The consistency of performance on complexity-choice between various groups and for different aggregates of data were studied. Retarded and non-retarded groups both showed similar degrees of systematic responsivity with reference to complexity-choice, although they differed in the distributions of their complexity-choice rates. All groups showed weak-to-moderate transitivity on the average with regard to stimulus sets. Differences between and within groups for complexity dimensions were noted. Also examined were degree of interrelationship for dimensions, and for retardates, reliability of various data aggregates.

IV. Comparison of Forced-Choice and Fixation Methodologies in Non-retarded Subjects.

Early work in the study of human perceptual curiosity (i.e., Berlyne, 1957, 1958), and a great deal of research since, (viz; Leckart & Faw, 1968), has studied relative response to stimulus complexity in terms of amount of visual fixation upon complex stimuli. In contrast, the experiments by Hoats, Miller, and Spitz (1963), among others, and for most of the work reported herein, make use of a molar response, complexity-choice, as an index of perceptual curiosity. An implicit assumption in our work is that choice is grossly analagous to fixation rate, i.e., that the subject in a fixation experiment is in a sense choosing

to fixate relatively complex or non-complex aspects of the stimulus array he is confronted with. Of course, in a fixation experiment, the subject may shift his gaze over the array, while in the forced-choice method, this is only possible during the initial exposure period. However, fixation experiments ordinarily use the aspect of the array upon which the subject's gaze was fixed a majority of the time as the primary dependent variable. One could assume that the subject's choice after a brief initial exposure to the stimulus array is quite comparable to gross fixation rate given a more continuous exposure period.

But, how tenable is that assumption? The present experiment was undertaken in order to explore its tenability.

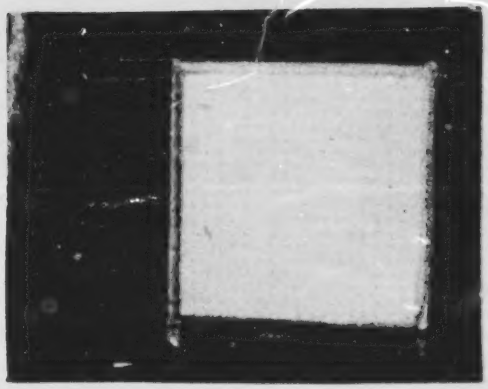
Method

Paradigms. There were three experimental paradigms employed. The first paradigm, CFC, consisted of Pentablock I under standard conditions for complexity-choice behavior as in Experiments III.1 and III.3; Pentablock II for studying fixation behavior; and Pentablock III again under complexity-choice. In the second paradigm, FCF, the foregoing sequence was inverted, i.e., Pentablock I for fixation, Pentablock II for choice, and Pentablock III again for fixation. The third paradigm, CFCC, was a modification of the first, with a repeat of Pentablock II at the end of the sequence but now under complexity-choice conditions.

Subjects. A total of 65 college students (33 females, 32 males; 31 freshmen, 16 sophomores, and 18 juniors) were randomly assigned to one of the three paradigms, with 29 subjects assigned to CFC, 12 subjects to FCF, and 24 subjects to CFCC. All subjects had been members of the same larger pool of subjects as was sampled in Experiment III.1, and were quite comparable in terms of characteristics to that sample.

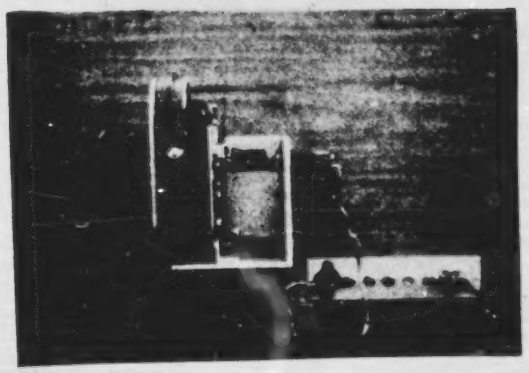
Apparatus. The Visual Test Module (VTM) was used for study of complexity-choice, as in earlier experiments. To study fixation behavior, a Hess pupillometer was employed. This equipment, pictured in Figure 6, consists of a rectangular box which the subject looks into at one end, and with a plastic screen at the other end. Outside the right wall of the box (from the subject's perspective), a Bolex 16 mm. movie camera is bracketed together with a small electric motor for driving the camera. The camera is fitted with a macrolens for extreme closeup cinematography. Inside the box, on the left wall but out of the subject's line of vision, a small mirror is bracketed in line with the camera's lens. The mirror is adjustable to accomodate a reflection of the subject's left eye. The floor of the box is fitted with two light fixtures, one used

subject's view



rear view

uncovered, top view



side view, showing camera and control switches

Figure 6.
Hess pupillometer (several views), used in fixation and pupillary studies.

for making adjustments on the mirror, focusing etc., and the other, a low-yield red bulb, used as a source of lighting during data acquisition. The red bulb can be seen by the subject, e.g., if he shifts his gaze from the screen to the floor. Under these conditions of low illuminance, infrared film must be used.

Procedure. Instructions for complexity-choice (C) conditions were the same as employed in Experiments III.1 and III.3, with minor additions when a subject was shifted from the fixation (F) conditions (i.e., "Now, we'll go back to the other equipment. Once again, look at the two pictures and when they go off, choose the one, on the left or on the right, that you want to see more of.")

For F conditions, subjects were introduced to the apparatus and asked to look into the opening while adjustments were made. Then, the white light was switched off, the subject faced the experimenter, and the following instructions were given:

"I want you to look inside the box at the screen in the back. You will be shown pictures on the screen. Your job is to keep count of the number of pictures you will be shown. The pictures stay on the screen for a fairly long time, so that it's difficult to keep count. There is nothing else you have to do. At the end, I will ask you how many you saw. Before we begin, I will say 'ready', when you must look at the screen. The first picture you will see is an 'X' in the middle of the screen. I will say 'ready' just before a new set of pictures comes on."

Each stimulus pair was exposed for 10 sec., with a 2-sec. inter-trial interval for automatic change of slides. The film was driven at the rate of 2 frames/sec. Over 10-sec. exposures, there were thus 20 frames per stimulus pair, with an additional 4 frames between trials. Subjects were actually asked how many pictures they saw at the conckusion of a fixation pentablock, but these estimates were ignored in analyses.

Results and Discussion

Film analyses. After processing, which revealed spoiled film for 3 subjects, useable film protocols were scored separately by each of two assistants for left vs. right gaze per frame. Scoring was done frame by frame, (discounting the intertrial frames) with film projected by a Perceptoscope which amplified the image 6 times onto a screen fixed in the center of a scoring table. Artifacts (eye-blinks, or gazes at the floor of the box, which were easily evident by the position of the pupil and iris) were discounted. A protocol for any stimulus pair was scored complex if

a majority of frames showed the gaze towards the position of the complex member, and scored simple if the opposite were true. When an equal number of frames were in the complex and simple positions (a relatively rare occurrence), the stimulus pair was discounted and total score over a pentablock was prorated accordingly.

As noted, film protocols were scored twice, once by each assistant. Degree of agreement between scorers fell into two categories: 80% or better agreement, or around 50% (chance) agreement. The latter group, consisting of protocols for 30 subjects, were discounted. It is not known whether this attrition rate is typical or unusual for such experiments, but it is certainly large. For the former group, stimulus pair discrepancies between scorers were individually adjudicated by them. What remained for further analysis were film protocols for 17 subjects in the CFC sequence, 6 subjects in the FCF sequence, and 9 subjects in the CFCC sequence.

Correlation of Fixation and Choice Scores. Since the CFC and CFCC paradigms were identical except for the re-introduction of Pentablock II as a final condition in CFCC, it was possible to pool available film protocols for CFC and CFCC subjects for most analyses. The relationships between scores for Pentablocks I vs. II, I vs. III, and II vs. III (C vs. F, C vs. C, and F vs. C respectively) were considered by examining correlations over the 26 available subjects for these pentablocks. The results are given in Table 17.

Table 17.

Intercorrelations and Means of Pentablocks Administered Under Choice or Fixation Conditions (N=26)

	PENTABLOCK			MEANS
	I	II	III	
I (C)	--	.664	.905	14.96
II (F)		--	.634	16.19
III (C)			--	14.81

It can be seen upon inspection of Table 17 that the correlations between C and F conditions (Pentablocks I vs. II, and II vs. III show that between 40 and 44% of the variance is accounted for in common by these two measures. In view of the many limitations in the fixation method employed, it is reasonable to see this outcome as underestimating the degree of congruence between the methods, and conclude that a similar process underlies both types of response.

The high correlation between Pentablocks I and III (both complexity-choice) can be compared favorably with a similar correlation over the 27 subjects for whom film protocols were unreliable, i.e., the $\underline{r}$ for Pentablocks I and III for these 27 subjects = .893. Thus, we have rather oblique evidence that these subjects contributing non-useable film protocols were not an otherwise biased sub-sample.

It was possible to consider the correlation for Pentablock II, administered twice to subjects in the CFCC paradigm, for the small group of 9 subjects whose film protocols survived the reliability test. For these subjects, $\underline{r}$ for Pentablock II under complexity-choice ($\overline{X}$ = 16.00) and under fixation ($\overline{X}$ = 17.00) was .762, significant beyond the .01 level.

Further, it was also possible to examine intercorrelations of pentablocks for the 6 subjects with useable film protocols in the FC condition. For I vs. III (both fixation), $\underline{r}$ = .946. The correlations for I vs. II (F, then C) and II vs. III (C, then F) were .844 and .743, respectively. Despite the very small N's in this and the prior analysis, these results confirm those reported in Table 17, and further support the argument that complexity-choice and fixation-time methods share an underlying process in common.

Analysis of Pentablocks in CFCC Paradigm. Finally, for all subjects in the CFCC paradigm, it was possible to perform an analysis of variance for pentablocks under the complexity-choice condition, to test comparability of effects with similar analyses conducted for data in III.1, III.2, and III.3. The results of this analysis are given in Table 18.

Table 18.

Analysis of Variance for Three Pentablocks Under Complexity-Choice Instructions for CFCC Condition (N=24)

Source	df	ms	F
Ss	23	132.82	
Pentablocks (A)	2	7.35	<1
A X S	46	35.47	

Unlike results for subjects who are not involved in the fixation approach, CFCC subjects do not show a significant pentablock effect over time. The means for Pentablocks I, II (actually readministered for the CFCC group as the final pentablock) and III are 15.00, 15.00, and 14.04 respectively. Since Pentablock II had already been seen by these subjects under fixation conditions, there is an apparent tendency to increase complexity-choice after prior exposure to stimuli, if these findings are taken against the significant decrease for the final pentablock in earlier experiments. However, since the mean complexity scores for the same pentablocks under fixation appear to be higher than under choice (e.g., the mean for Pentablock II = 16.19 in Table 17) there is probably no "reverse novelty" effect to concern us.

Summary

Two methods for studying perceptual curiosity, complexity-choice and visual fixation on complex stimuli, were compared. In general, the two methods were found quite comparable, yielding considerable common variance despite a number of difficulties with the fixation method, which were noted.

V. Perceptual Curiosity in Retarded and Norma-IQ Adolescents: Effects of Age, Trials, Sex, Complexity Dimensions, Type of Pairing, and IQ Level.

Hoats, Miller and Spitz (1963) studied perceptual curiosity (i.e., complexity-choice) in institutionalized retardates and community-based regular class high school students of like age to the retarded subjects. They found that in general, retardates showed significantly less perceptual curiosity than did the presumably non-retarded subjects. In addition, Hoats et al. found different effects over trials, with retardates showing decreased complexity-choice over trials, contrasted with the opposite effect in non-retarded adolescents. Furthermore, Hoats, et al. found an interaction between sex of subject and presumed intellectual level, with differential sex effects for the retardate group as contrasted with no differences for the high-school group. Finally, there were differences between High- vs. Low IQ halves of the retarded sample, with low-IQ retardates showing significantly greater complexity-choice than High-IQ retardates.

Several methodological factors lead to questions about the findings in the studies by Hoats and his colleagues. First, intellectual level was confounded with the institutionalized status of retardates and the normal community status for the presumably non-retarded subjects. Second, IQs were unavailable for high-school subjects who served in the non-retarded sample, introducing the possibility of sampling error or bias in this regard. Third, nothing was established in the way of socio-economic comparability between the groups, no small consideration since institutionalized retardates in the educable range are likely to come from the lowest socio-economic levels.

The present study was conceived in large part to correct the possible shortcomings just addressed. It serves therefore as the closest to a direct replication of the study of Hoats, et al., among the various experiments contained in this report. Aside from examining for effects of intellectual level, trials, and sex in retarded and non-retarded subjects of known IQ and with all subjects community-based, it was also possible to consider differences in the various complexity dimensions, and in the type of complexity pairing, i.e., HI vs. LO, HI vs. MID, and MID vs. LO, between retarded and non-retarded groups.

Method

Subjects. Based upon scores on the Otis (Gamma) Intelligence Scale, 12 students (6 male, 6 female) from each of grades 9, 10, 11, and 12 in suburban northern New Jersey junior and senior high schools were selected to constitute a normal-IQ (N-IQ) sample of 48 subjects. A sample of 48 mentally retarded (MR) subjects, with 12 subjects who were age-equivalent to each grade level (9 through 12), were drawn from special classes in the same schools contributing to the N-IQ sample. There were 24 males and 24 females in the MR sample, but unlike the N-IQ sample, sex were not distributed equally over age levels for retardates.

Apparatus and Material. The Visual Test Module, as employed in other experiments reported herein, was used in this study. Stimuli consisted of the 30 items which best discriminated out of all 90 items, as reported in III.2. There were 5 trial blocks of 6 trials each, with each of the 6 complexity dimensions represented in a trial block. Of the 30 trials, each a stimulus pair, 19 were HI-LO pairings, 4 were HI-MID pairings, and 7 were MID-LO pairings. The sequence of trials is given in Table 19. Identification of actual stimuli employed may be accomplished by reference to Figure 1.

Table 19.

Sequence of Trials Used in 30-Item Series

BLOCK #	ITEM #	DIMENSION	SET	PAIR	COMPLEXITY POSITION: LEFT or RIGHT
I	1.	A	1	HI-LO	L
	2.	B	5	HI-MID	R
	3.	C	2	HI-LO	R
	4.	D	3	MID-LO	L
	5.	E	1	MID-LO	L
	6.	F	3	HI-LO	R
II	7.	C	5	MID-LO	L
	8.	A	2	HI-LO	R
	9.	E	4	MID-LO	L
	10.	B	2	HI-MID	R
	11.	F	5	HI-LO	R
	12.	D	1	HI-LO	L
III	13.	B	1	HI-MID	L
	14.	E	2	HI-LO	R
	15.	A	4	HI-LO	L
	16.	F	2	HI-LO	R
	17.	D	5	HI-LO	R
	18.	C	3	HI-LO	L
IV	19.	E	5	HI-LO	R
	20.	D	2	MID-LO	L
	21.	F	4	HI-LO	R
	22.	C	1	HI-LO	L

BLOCK #	ITEM #	DIMENSION	SET	PAIR	COMPLEXITY POSITION: LEFT or RIGHT
	23.	B	3	HI-MID	L
	24.	A	3	HI-LO	R
V	25.	F	1	MID-LO	R
	26.	C	4	HI-LO	L
	27.	D	4	HI-LO	R
	28.	E	3	HI-LO	L
	29.	A	5	HI-LO	L
	30.	B	4	MID-LO	R

Procedure. The same instructions as employed in experiments with the 90-item series, e.g., as in III.1, were used here, except that subjects completed the entire (30-item) series in a single setting.

Results and Discussion

Characteristics of MR and N-IQ groups with respect to age, IQ, and socio-economic status are given in Table 20.

Table 20.

Characteristics of MR and N-IQ Groups

Group		MEASURE CA	IQ	SES
MR	Mean	16.03	68.14	3.43
(N=48)	S.D.	1.42	9.77	1.70
N-IQ	Mean	16.38	104.37	2.92
(N=48)	S.D.	.95	8.45	1.54

MR and N-IQ groups did not differ significantly on chronological age and socio-economic status. There was of course a highly significant difference in IQ (no overlap) between the groups.

Complexity-Choice: Effects of Intellectual Level, Grade, and Trial Blocks.

The initial analysis on complexity-choice data in this study considered differences between MR and N-IQ groups in a simultaneous consideration of effects of grade or age equivalent, and of trial blocks. Results of this analysis of variance are summarized in Table 21.

Table 21.

Analysis of Variance of Complexity-Choice in MR and N-IQ Groups as Functions of Grade or Age Equivalent and Trial Blocks.

Source	df	ms	F	F.95
Ss	95	11.39		
Grade or Equivalent (B)	3	27.13	3.26	2.70
Groups (C)	1	191.27	23.04	3.95
B x C	3	26.22	3.75	2.70
error (b)	89			
Trial Blocks (A)	4	6.24	5.28	2.37
A x B	12	.60	<1	1.75
A x C	4	2.32	1.95	2.37
A x B x C	12	.93	<1	1.75
error (w)	352	1.15		

Inspection of Table 21 reveals several noteworthy effects. There is first a significant interaction between groups and grade level which qualifies the highly reliable difference between groups over-all, and which calls for additional analysis (see below.) Further, while there is a significant effect for trial blocks, this effect does not interact significantly with grade level, groups, or their combinations. The lack of a significant trial blocks by group (AC) interaction is unlike that found by Hoats, et al., (1963), where it will be recalled that a significant groups trial blocks interaction could be explained by an increase in complexity-choice over trial blocks by HS subjects, while retardates showed a decrease over trial blocks. In the present study, means for both groups combined on trial blocks I through V are 2.70, 2.77, 3.17, 2.89, and 2.48, respectively. Block III is significantly higher than each of the other blocks, and the effect is quite reminiscent of an "inverted" U" or arousal function. The curves for MR and N-IQ groups over blocks are presented graphically in Figure 7. It may be seen that the inverted U effect is most apparent for the N-IQ group, although as already noted, these two curves do not differ significantly except overall.

Despite the resemblance to arousal functions, the reader is cautioned that these curves are in striking contrast to those found under quite similar circumstances in Hoats, et al. While there are refinements in sampling followed here which could suggest that the present results are a more "accurate" reflection of complexity-choice effects over time in the two groups, it is not known whether or not all such effects, i.e., those reported here as well as those in Hoats, et al., are not artifacts of peculiarities in stimulus sequencing. Unfortunately, this cannot be ruled out of the present study, since only one sequence was employed.

Further analysis of the significant Grade x Group (BC) interaction noted in Table 21 reveals that, whereas the MR group shows no significant differences between grade-equivalent subgroups for complexity-choice, there is a marked and orderly decline in N-IQ subgroups as a function of grade (age) level. Means for the various subgroups are presented in Table 22, while Figure 8 shows curves for the N-IQ subgroups by grade level over trial blocks.

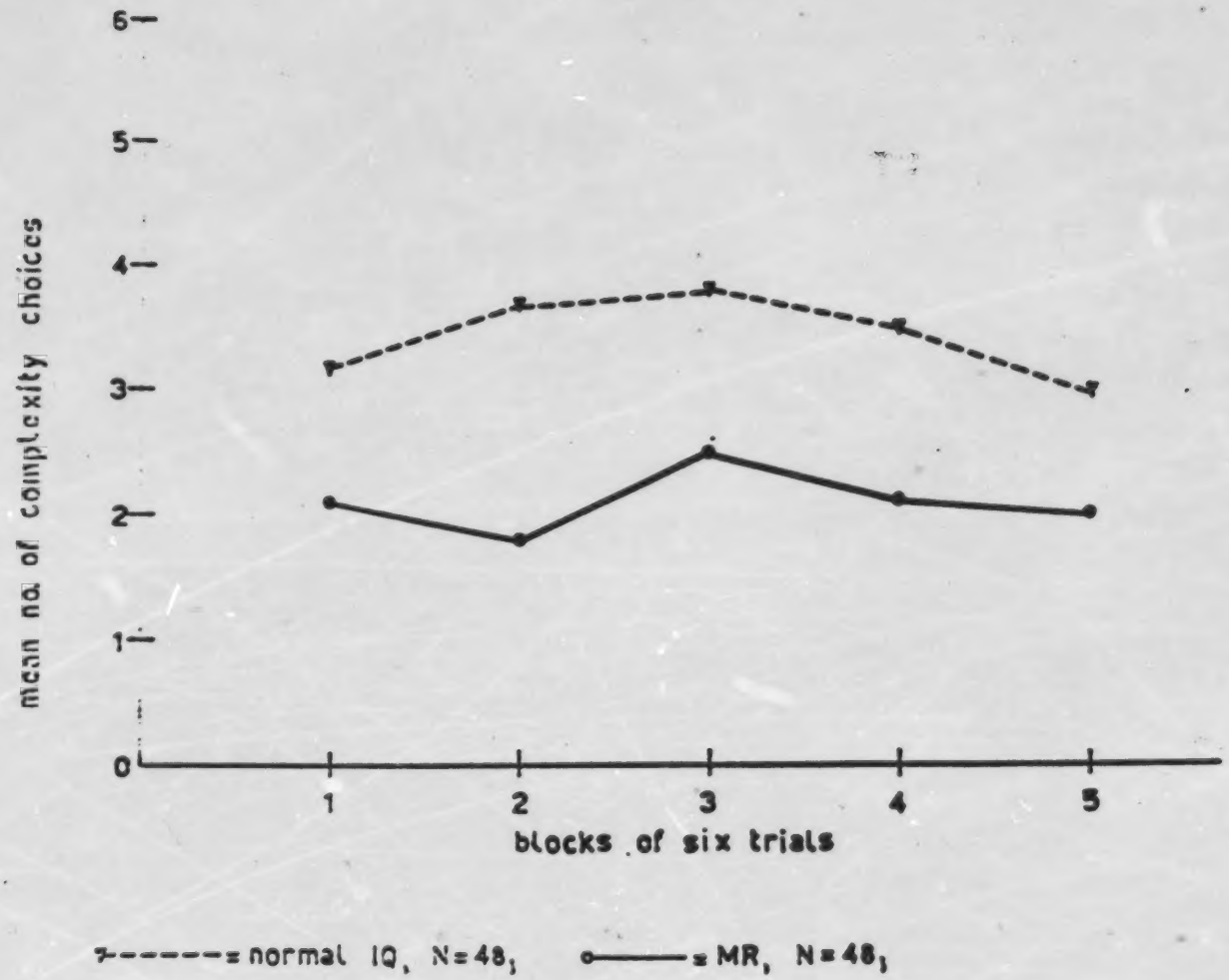


Figure 7.
Complexity-choice over trial blocks for MR and N-IQ groups.

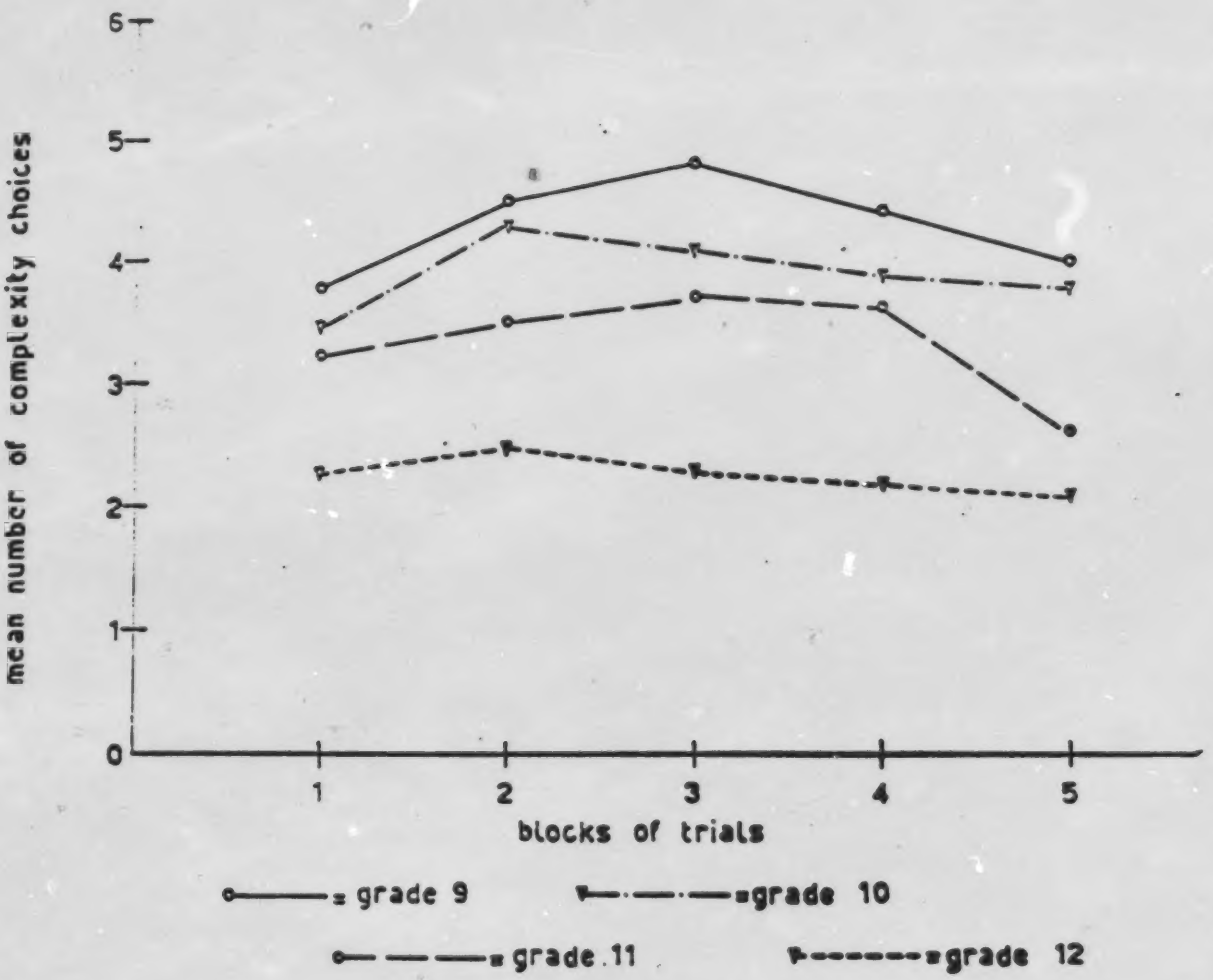


Figure 8.
Complexity-choice over trial blocks for N-IQ subgroups by grade level.

Table 22.

Complexity-Choice Means For N-IQ and MR Subgroups (n-12)
By Grade or Age-Equivalent.

	Grade or Equivalent				
Group	9	10	11	12	F
MR	11.16	10.91	11.16	11.00	<1.00
N-IQ	22.41	19.16	16.66	11.25	8.17
					$p < .01$

Data for N-IQ subgroups, when separately analyzed, show a significant effect for grade level, with grade 12 significantly lower than the others, and with grade 9 significantly higher than grade 11 as well. As suggested by visual inspection of the means for the MR subgroups, there are no differences between them. Further, MR and N-IQ subgroups differ significantly from each other at grades 9 through 11, but not at grade 12. In effect, N-IQ subjects take three years to "attain" the level of complexity-choice reflected by MR subjects throughout the age range sampled.

The clear-cut age effect for N-IQ subgroups, while unexpected in this study, is consistent with findings in other studies of the effects of age upon curiosity behavior, e.g., Thomas (1966). There are several possible explanations for the observed effect. One would hold that the N-IQ subgroups are reflecting an increasingly restrictive intellectual climate of the public high school system, e.g., increased emphasis on convergent activity with advancement by grade. Therefore, 11th-graders "know" best that one does not venture into ambiguous stimulus territory for information.

A second possibility takes account of the fact that the N-IQ group in this study are not necessarily typical intellectually in their schools. On the contrary, it has already been noted that restriction of the N-IQ sample to subjects in the IQ 90 to 110 range was not easily or altogether successfully accomplished, since Otis IQs for high-school students initially sampled tended to exceed this range. It is conceivable that suburban high school students with IQs in the strictly normal range are underfunctioning academically relative to a majority of their peers. This is

especially likely if the school system pitches its curriculum demands to relatively high-functioning students; if this is the case, it should be increasingly true with progress by grade, i.e., curriculum demands should increase with approach to graduation and college entrance time. N-IQ individuals in this kind of setting could respond to these demands, and their relative difficulty in meeting them, by a pattern quite similar to that shown by mentally retarded youngsters much earlier in their academic histories. That is, N-IQ subjects in this study could be showing an increasing aversion to stimulus complexity, in response to relative difficulty in meeting them, by a pattern quite similar to that shown by mentally retarded youngsters much earlier in their academic histories. That is, N-IQ subjects in this study could be showing an increasing aversion to stimulus complexity, in response to relative difficulty, i.e., relative academic retardation, in coping with new informational contexts in the suburban middle-class school setting.

A third possibility is that perceptual curiosity naturally declines with development in normally functioning individuals, or perhaps, shows a cyclical trend with development that is masked by the age range sampled in this study. This notion follows if perceptual curiosity serves to prime pursuit of information in its early stages, but that later stages require the opportunity to consolidate or synthesize information already acquired, hence a relative distaste for new and ambiguous informational resources during these later stages. The possibility that this effect is a cyclical one is raised because once consolidation has been accomplished, the individual may then be ready for forays into new informational contexts, requiring the priming function of perceptual curiosity. Inconsistencies between findings on curiosity behavior in infants may be reflective of such cyclicity, i.e., since there is relatively little consistency in the ages of infants sampled across such studies, some differences in findings across them may be a function of even small variations in level of development for the samples.

In the current project, we have noted that college students tended generally towards greater perceptual curiosity (i.e., higher complexity-choice rates) than high school students. Is this also reflective of the possible cyclicity of perceptual curiosity behavior, just discussed? One way to consider this is to examine available data (on the 90-item series) for college students, leveling for years in college (freshmen, sophomores, or juniors.) If there were a decline with college year level in complexity-choice, this would be consistent with the cyclicity notion. Results of an analysis of variance on complexity-choice for college students by year in college are summarized in Table 23.

Table 23.

Analysis of Variance of Complexity-Choice Rate in College Subjects as A Function of Year Level (N=81)

Source	df	ms	F
Year Level	2	874.82	1.54
within	78	567.36	

For the analysis summarized in Table 23, data were employed for 42 freshmen, 18 sophomores, and 21 juniors who either participated in Experiment III.1 or were involved in the CFCC paradigm in Experiment IV. While the F for differences between year levels shown in Table 23 is clearly non-significant, mean complexity-choice rates for freshmen, sophomores, and juniors were 50.26, 49.00, and 39.19 respectively, grossly consistent with the grade level effect in N-IQ (high school) subgroups. This finding lends a semblance of credibility, albeit with quite weak support to the cyclicity hypothesis.

Sex Differences. Hoats, et al. (1963) found that comparing retarded and non-retarded groups of like age, sex interacted with complexity-choice, such that retarded females exceeded retarded males, but there were no differences for non-retarded males and females. In the present study, mean overall complexity-choice rates for MR males = 11.25, and for MR females = 10.87, with $t < 1$. A similar comparison of N-IQ males and females showed that mean complexity-choice rate for N-IQ males = 15.66, and for N-IQ females = 18.29, with $t = 1.49$, $p > .10$. The latter finding confirms the lack of sex differences in Hoats, et al., while the failure to find sex differences in retardates diverges from the earlier study. Most directly, we can conclude that sex differences which obtain for perceptual curiosity behavior in an institutionalized MR sample do not obtain for community-based MR subjects.

Dimension Effects. Comparisons were possible between MR and N-IQ groups for differences on the 6 complexity dimensions, A through F. Since retarded and non-retarded groups did not differ in all dimensions in 90-item series analyses (Experiment III.3) it was important to check for replicability of those findings with retarded and non-retarded samples that are more generally comparable with regard to such characteristics as age and SES. In addition, because of significant grade level effects found with N-IQ subjects, similar analyses were conducted with respect to dimensions.

Table 24 gives mean complexity-choice rates on each di-dimension (maximum rate of 5 per dimension) for the MR and N-IQ groups. The analysis of variance summarized in Table 25 is with reference to these data. Figure 9 presents these same data graphically.

Table 24.

Mean Complexity-Choice Per Dimension In MR and N-IQ Groups.

	DIMENSION					
GROUP	A	B	C	D	E	F
MR (N=48)	1.68	3.12	2.16	1.02	1.75	1.31
N-IQ (N=48)	2.75	3.52	3.18	2.56	2.33	2.62

Table 25.

Analysis of Variance of Complexity-Choice Per Dimensions in MR and N-IQ Groups.

Source	df	ms	F	F.95
Ss	95	9.49		
Groups (B)	1	159.39	20.17	3.95
error (b)	94	7.90		
Dimensions (A)	5	31.53	30.61	2.21
AB	5	4.36	4.23	2.21
error (w)	470	1.03		

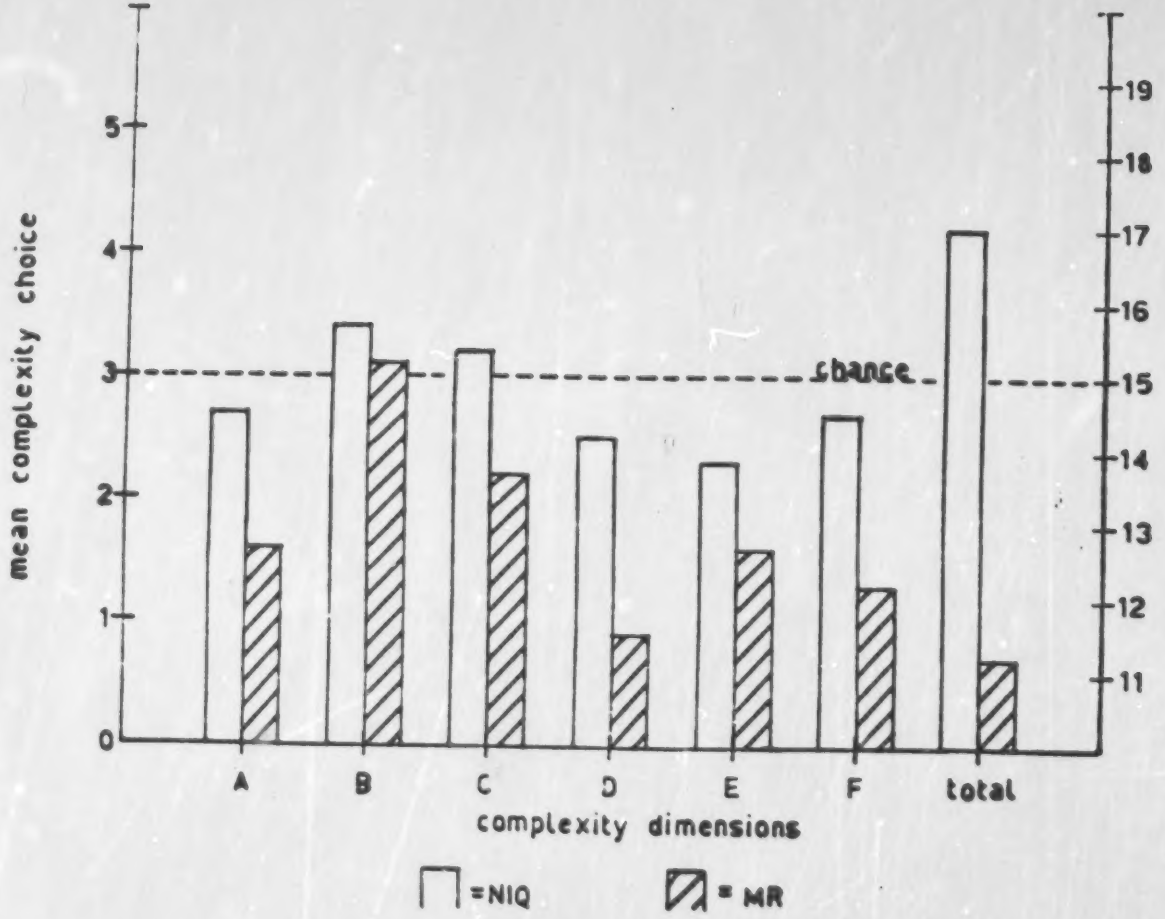


Figure 9.
Complexity-choice in the six dimensions for MR and N-IQ groups.

In view of the significant Dimensions x Group interaction noted in Table 25, comparisons were conducted between the group for each dimension, and between dimensions for each group at a time. Comparisons per dimension between the groups showed that N-IQ exceeded MR on all dimensions but B, Amount of Material. Differences for Dimensions A, C, D, and F were significant beyond the .01 level, while the difference for Dimension E, Incongruity, was significant at the .05 level. These findings are generally consistent with those for the 90-item series, with the exception of the non-significant effect on Incongruity.

Analysis of the MR group alone with respect to dimensions showed that Amount of Material yielded a complexity-choice rate significantly higher, at or beyond the .05 level, than all other dimensions. Further, Dimension D, Irregularity of Design, was significantly lower for Mrs than all other dimensions except F, Incongruous Juxtaposition. All other dimensional differences were significant except A vs. E.

An analysis of variance on dimensions for the N-IQ group also took grade level into account. The results of this analysis are summarized in Table 26. Figure 10 presents these data graphically.

Table 26.

Analysis of Variance of Complexity-Choice Per Dimensions In N-IQ Subjects As A Function of Grade Level.

Source	df	ms	F.
Ss	47	11.47	
Grade Level (B)	3	44.09	4.77
error (b)	44	9.24	
Dimensions (A)	5	9.60	9.89
AB	15	.45	<1
error (w)	220	.97	

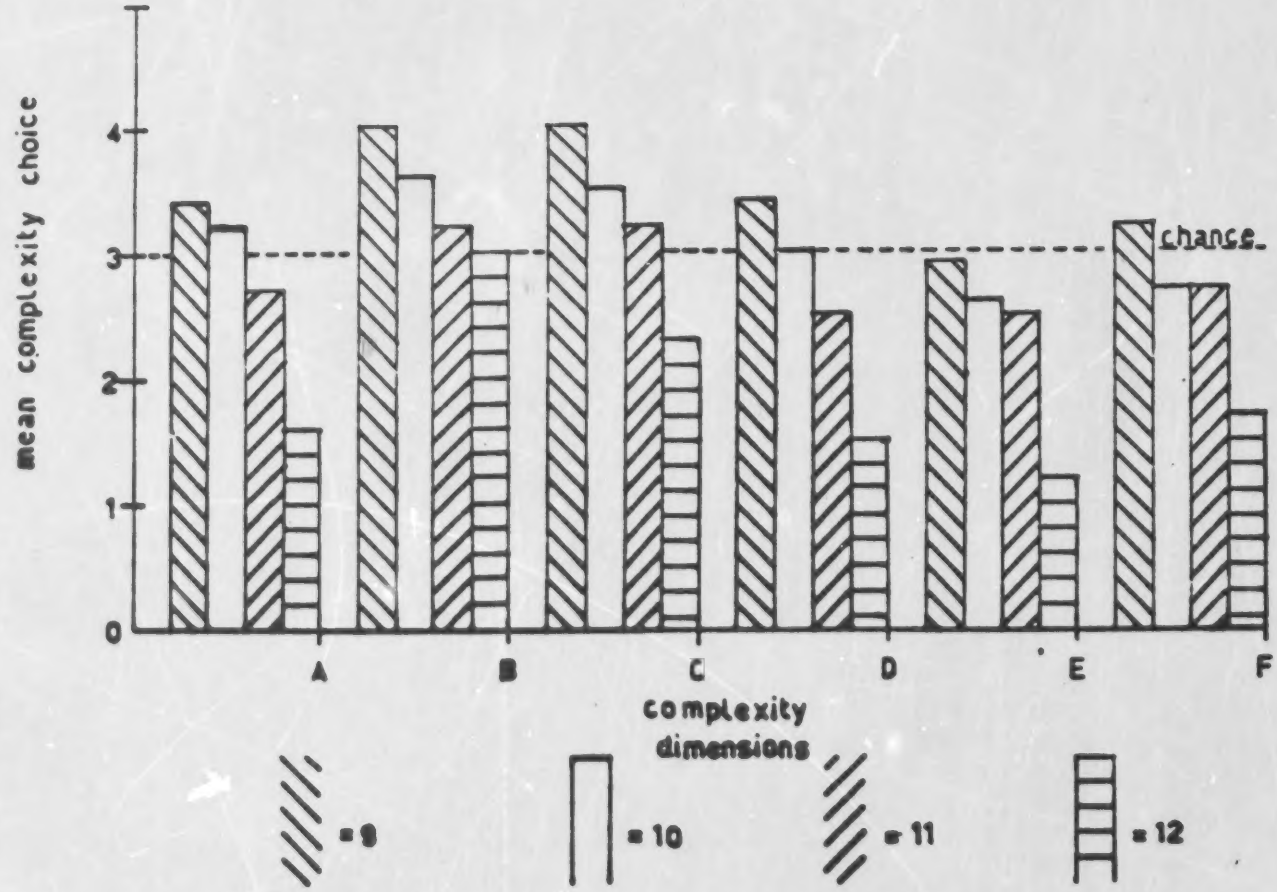


Figure 10.
Complexity-choice in the six dimensions for N-IQ subgroups by grade level.

The failure to find a significant Dimension x Grade Level interaction in N-IQ subjects reveals that dimensional effects are evidently uniform across grades. When complexity-choice rates per dimension are compared for the complete N-IQ group, there are significant differences between dimensions on all comparisons except A vs. D, A vs. F, B vs. C, D vs. E, D vs. F, and E vs. F. Whereas B, Amount of Material, showed significantly higher complexity-choice rates than all other dimensions in the MR group, the N-IQ group does not show differences between Amount of Material and C, Heterogeneity of Elements.

That B, Amount of Material fails to discriminate between retarded and non-retarded groups is consistent with earlier findings to the effect that this dimension is essentially unrelated to the others. The relatively high complexity-choice rates on B is also consistent with those earlier findings and creates a similar dilemma with respect to the interpretation of this result. Once again, no sound conclusion is possible in the absence of independent validity tests of the relevance of complexity-choice rate for Amount of Material, as considered against that for the other dimensions.

Type of Pairing. It has been noted that, in the 30-item series, 19 were HI-LO pairings, 4 were HI-MID pairings, and 7 were MID-LO pairings (see Table 19). MR and N-IQ groups were compared for differential effects in complexity-choice rate for each type of pairing. This represents an additional test of the Dember and Earl hypothesis, in that one could expect relatively greater complexity-choice in MID-LO as compared to HI-LO pairings because of the more modest complexity level in the MID-LO pairs. In addition, N-IQ subjects were again considered for differentiation according to grade level, now with respect to each type of pairing.

MR vs. N-IQ comparisons for each type of pairing show significant differences between the groups for HI-LO and MID-LO pairings, but not for HI-MID pairings. It should be immediately noted that all HI-MID pairs were drawn from Dimension B, Amount of Material, so that failure to find differences in this regard are obviously consistent with those discussed above. Within the MR group alone, there were no differences between rates for HI-LO and MID-LO pairings; in fact average percentage of choice on MID-LO pairings was 29.91%, compared with 33.08% on the average for HI-LO pairings. HI-MID pairings significantly exceeded the other two types in the MR group. These findings once again support a generalized avoidance hypothesis, except with regard to HI-MID (Dimension B) pairings, and are not supportive of our extrapolation of the Dember-Earl hypothesis to this class of data.

In the N-IQ group alone, significant grade effects were found for HI-LO and MID-LO pairings, with grade 9 significantly higher than grade 12 for each of these types, while no grade effect was found on HI-MID pairings. Differences between types of pairings for the N-IQ group were quite comparable to those for the MR group.

IQ Level Difference in MR Group. Hoats, et al. reported that relatively low-IQ retarded subjects showed significantly higher complexity-choice rates than relatively high-IQ retardates. Our data were similarly compared except that performance over trial blocks were additionally taken into account. The total of 48 MR subjects in the present study was subdivided into a High-IQ group (IQs 70-84) and a Low-IQ group (IQs 51-69), with 24 subjects in each subgroup. The results of the analysis of these data are summarized in Table 27.

Table 27.

Analysis of Variance of Complexity-Choice Over Trial Blocks for High-IQ and Low-IQ MR Subgroups.

Source	df	ms	F	F.95
Ss	47	4.46		
IQ Level (B)	1	.21	<1	4.07
error (b)	46	4.55		
Trial Blocks (A)	4	2.22	2.78	2.37
AB	4	3.63	4.54	2.37
error (w)	184	.80		

The results summarized in Table 27 reveal no overall differences between High- and Low-IQ retardates. They do however show a significant Trial Block x IQ Level interaction. This is amplified by the means per trial block for each IQ-Level subgroup, presented in Table 28.

Table 28.

Means Per Trial Block And Over All Items For High-IQ and Low-IQ Subgroups (N=24 Per Subgroup)

	Trial Block					Total
Group	I	II	III	IV	V	
High IQ	1.95	1.66	2.83	2.29	2.16	10.91
Low IQ	2.66	2.20	2.25	2.20	1.87	11.20

Overall, High- and Low-IQ subgroups end up with about the same complexity-choice rates. But clearly, the inverted-U effect noted earlier over trial blocks only obtains for the High-IQ MR subgroup. In the Low-IQ subgroup, there is deceleration in complexity-choice over trial blocks, comparable to that found for all retardates in Hoats, et al. The differences between Trial Blocks I and V for the Low-IQ subjects is significant beyond the .01 level. Furthermore, in comparing High- and Low-IQ subgroups per trial block, Low-IQ MRs in Trial Block I significantly exceed High-IQ MRs. This finding is consistent with an unreported analysis of similar data in Hoats, et al., showing a significant drop in Low-IQ retardates over trials, but a steady, low rate for High-IQ retardates. In both instances, it appears that relatively low-IQ MR subjects need greater exposure to stimuli which they ultimately find noxious than do relatively high IQ MR subjects.

Effects for the High-IQ subgroup over trial blocks shows that complexity-choice rate on Trial Block III significantly exceeds that on the other trial blocks, consistent with findings for all subjects combined, reported earlier.

Summary

Retarded (MR) and Normal-IQ (N-IQ) high-school age adolescents were studied for complexity-choice rate over a 30-item series. In general, N-IQ subjects exceeded MRs in complexity-choice rate, confirming earlier findings. An inverse effect of age upon complexity-choice rate in N-IQ subjects did not occur with MRs, who showed consistency with low rates for all age subgroups. Both N-IQ and MR groups showed an inverted-U effect over Trials. Differential effects of complexity dimensions were noted. An examination of effects of degree of differentiation between stimuli, to study theory of interaction between complexity levels of stimuli and individuals, showed no differences explainable in terms of that theory. There were no significant effects

due to sex, disconfirming earlier findings. Higher-IQ retardates showed different complexity-choice effects over trials than lower-IQ retardates, but no significant differences overall.

VI. Decision-Time and Duration of Response to Stimulus Complexity.

For experiments involving the Visual Test Module within this project, it was intended that decision-time (latency between initial exposure of a stimulus pair and choice of a pair member) and duration of response (amount of time a chosen pair member is held into view by a subject) be monitored in all instances. This was thought to be possible because provisions were made in the design of the apparatus for these express purposes. Clocks measured each of these variables to hundredths of a second, and at the conclusion of a triad cycle, i.e., when a subject released his chosen pair member, clock data were transferred to a paper tape punch which coded and recorded latency and duration results for that trial.

However, because of frequent breakdowns in the apparatus, including malfunctioning of clocks and of the paper tape punch, resultant latency and duration data were fragmentary. This section of the report describes a series of analyses on available latency and duration data, i.e., for those non-retarded subjects on the 90-item series for whom complete or nearly complete data were available, and for a group of retarded subjects who participated on the 30-item series.

Results.

In all analyses, to be reported here, median latencies or response durations for a given set of items per object were treated as the basic data. Specification of item sets is given in each analysis noted.

Non-retarded Subjects: Latency Effects. Data for 40 college students who participated in Experiment III.1 were employed in these analyses. The first analysis considered differences in latency for each type of pairing: HI-LO, HI-MID, and MID-LO. It was anticipated that decision-time for pairings where differentiation between pair members was minimal, i.e., HI-MID and MID-LO, would be greater than for extreme differentiation between pair members, i.e., HI-LO pairings.

Median latency out of 30 items per type of pairing was noted for each subject. These medians were subjected to an analysis of variance, which is summarized in Table 29.

Table 29.

Analysis of Variance of Decision-Time Data As A Function of Type of Pairing in College Subjects (N=40)

Source	df	ms	F	F.95
Ss	39	513.61		
Type of pairing (A)	2	145.04	3.38	3.11
A x S	78	42.90		

The significant effect for type of pairing upon decision-time is explained by the fact that mean decision-time (latency) for HI-MID pairings = 1.627 sec., while those for HI-LO and MID-LO pairings = 1.516 sec., and 1.519 sec. respectively. Thus, our anticipation that proximity between pair members will increase decision-time is partially confirmed, since HI-MID pairings exceed the other two types, which are in turn equal to each other.

A second analysis of decision-time in non-retarded subjects was conducted with respect to possible differences between dimensions. This analysis is summarized in Table 30.

Table 30.

Analysis of Variance of Decision-Time Data As A Function of Dimensions in College Subjects (N=40)

Source	df	ms	F	F.95
Ss	39	263.43		
Dimensions (A)	5	37.70	2.25	2.26
A x S	195	16.74		

The main effect for decision-time as a function of dimensions barely misses significance at the .05 level. Proceeding with simple-effects analyses as though the main effect were reliable, it was found that decision-time for Dimension F (Incongruous Juxtaposition), significantly exceeded that for Dimensions B, C, D, and E, that decision-time for Dimension A (Irregularity of Arrangement) was greater than that for C (Heterogeneity of Elements), and that average decision-times for the other dimensions when compared were essentially equal. It can be noted that variation in decision-time was exceedingly slight from dimension to dimension. Mean decision-times for Dimensions A through F were 1.596, 1.549, 1.480, 1.522, 1.511, and 1.658 secs. respectively. Thus, the significant difference between Dimension F and C, most extreme of all differences, was less than 2/10 sec. on the average.

Duration of Response in Non-retarded Subjects. Duration of response (amount of time choice is held in by subject) data for the 40 subjects involved in the foregoing analyses was examined by first splitting the total group into a complex subgroup, n=27, with complexity-choice rates of 56 or more out of 90, and a simple subgroup, n=13, with complexity-choice scores of 52 or less. (This subdivision was the best possible for available data). Then, durations for each trial were tabulated and the data were arranged into 5 blocks of 15 trials each. An analysis of variance then considered differences in duration between simple and complex subgroups, as well as variations across trial blocks. The analysis across blocks was of interest since Berlyne (1958) had shown that amount of fixation on complex stimuli tended to increase over time in college students. It was anticipated that the same effect would occur with respect to duration of response over triads in the present data. Further, it was expected that the complex subgroup would show greater durations overall than the simple subgroup, since the former subgroup would have had more complex stimulation to visually explore than the latter group. Results of this analysis are summarized in Table 31.

Table 31.

Duration of Response as Function of Complex or Simple Classification and Trial Blocks in College Subjects.

Source	df	ms	F	F.95
Ss	39	2233.53		
Classification (B)	1	2660.78	1.19	4.09
error (b)	38	2222.28		
Trial Blocks (A)	4	57.04	2.47	2.37
AB	4	57.78	2.50	2.37
error (w)	152	22.47		

The foregoing analysis showed that, despite our expectation, complex and simple subgroups did not significantly differ overall in duration of response. However, there was a significant Classification (complex or simple) x Trial Block interaction, as well as a significant main effect for Trial Blocks. When each subgroup was separately analyzed, the simple subgroup showed no significant change across trial blocks, while the complex subgroup tended to show a linear effect in response duration over blocks. Means per trial within blocks for the two subgroups are presented in Table 32.

Table 32.

Mean Response Durations (In Seconds) Per Trials Within Blocks (15 Trials Per Block) in Complex and Simple Subgroups.

	Trial Block					Total
Group	I	II	III	IV	V	
Complex (n-27)	2.38	2.59	2.65	2.46	2.69	2.55
Simple (n=13)	2.11	1.93	2.03	2.05	2.06	2.03

The linear increase for the complex subgroup is compromised by the drop from Trial Blocks III to IV, a change that is significant at the .05 level. Differences between subgroups are significant at Trial Blocks II, III, and V. Thus, we can qualifiedly conclude that there is a change in duration of response over time comparable to Berlyne's findings, but only in the complex subgroup, and there is a tendency for complex-classified subjects to exceed simple-classified subjects in response duration.

Decision-time and Response Duration as Functions of Choice. It was also possible to consider differences in decision-time, and in duration of response, according to whether the choice for a given item was relatively simple or complex. With respect to decision time, it was conceivable that greater latencies (delays in responding) would be associated with one or another class of choice. With respect to response duration, it was anticipated that those for complex choices would exceed those for simple choices. That is, since relatively complex choices are implicitly more information-rich, it should follow that subjects would require more time to examine them.

For these analyses, the subdivision between simple and complex subgroups just described were followed. Then, for each subject, median latencies, and median response durations, for all items resulting in simple choices, and for those resulting in complex choices, were calculated. Next, median latencies to complex choices and for simple choices were compared in each subject, and a difference score was calculated. An identical procedure was followed with respect to response durations.

A comparison of latency differences for simple-vs.-complex-classified subgroups was significant. The differential latency effects leading to complex choices as contrasted with those leading to simple choices were examined for each subgroup at a time. For simple-classified subjects, there were no significant latency differences on complex vs. simple choices ($t = 1.56$, $p > .10$). However, for the complex-classified subgroup, latencies leading to simple choices significantly exceeded those leading to complex choices ($t = 2.54$, $p < .05$). That is, for complex-classified subjects, greater decision-time or delay in responding tended to precede relatively simple choices. In effect, if a complex-classified subject had relative difficulty in choosing a pair member, he was likely to opt for the relatively simple stimulus.

With regard to duration of response, there were no differences between the subgroups on differential time complex or simple choices were held into view. Therefore, the subgroups were combined. A t-test of differences between time complex choices were held vs. time holding simple choices, across the entire sample of

available non-retarded subjects, was significant, as expected ($t = 2.86$, $p < .01$). That is to say, subjects irrespective of classification were significantly likely to hold complex choices longer than simple choices, which is consistent with findings in Hoats, et al. (1963).

Decision-Time and Response Duration Effects in Retardates. Latency (decision-time) and duration of response data for retardates were only available for 20 subjects, and these had been run on the 30-item series. Analyses conducted on these data are therefore not truly comparable to the immediately foregoing analyses. In any event, median latencies per MR subject for trials which led to complex choices were compared with median latencies which led to simple choices. The resultant t for whether the difference between averages for the contrasting median latencies exceeded zero = 1.32, which was not statistically significant. However, a similar comparison of response durations, those for complex choices vs. those for simple choices, yielded a $t = 2.14$, which is significant beyond the .05 level with $df = 18$. That is, response durations to complex choices, while fewer in number for retardates, significantly exceeded response durations for simple choices. This finding is discrepant with results in Hoats, et al. which showed no differences in response duration for complex vs. simple choices in retardates. From the present and quite sparse data, we can only conclude that when retardates do choose to engage a relatively complex stimulus, they are likely to look longer at that stimulus than they would at more simple stimuli. Presumably then, curiosity in retardates, when it occurs, is guided by similar dynamics as obtained for non-retarded individuals.

Summary

Times to choice decision and response durations were variously examined for non-retarded and retarded groups. Decision-time was found to vary for different dimensions and for degree of differentiation between stimuli in non-retarded subjects. There was some tendency for decision-time to be greater when it led to simple over complex choices in non-retarded but not in retarded subjects. Both retarded and non-retarded groups showed longer response durations to complex over simple choices.

In college students, response durations tended to increase over trials for subjects with high complexity-choice rates, but were stable for low complexity-choice subjects.

VII. Exploration for Correlates of Perceptual Curiosity.

In the course of this project, it was feasible to consider the possibility of relationships between perceptual curiosity, as defined in terms of complexity-choice, and a number of other variables. Generally, the investigation for possible correlates began with the assumption that perceptual curiosity would tend to vary with certain specifiable dimensions, which taken together would essentially characterize degree of information-orientation across individuals. Without prior empirical basis, it was reasoned that perceptual curiosity would vary positively with such characteristics as degree of internal locus of control, tolerance for ambiguity, achievement motivation, and willingness to take risks. In addition, it was possible in some instances to examine for the relationship between complexity-choice and a measure of aesthetic judgment, as well as the degree of association between complexity-choice and another measure defined by its authors as a technique for assessing "spontaneous variation in behavior," thought here to be constructually related to complexity-choice.

An additional and underlying objective for examining correlations between complexity-choice and other variables was the anticipation of training new groups of retarded subjects to increased complexity-choice. In that regard, selection of subjects for training would depend on some justification that a given subject would otherwise be low-scoring, i.e., in the absence of training. Therefore, it was hoped that correlations between complexity-choice and some or all of the other variables considered would be of sufficient magnitude to justify use of scores on such other variables as predictors of complexity-choice rate.

Method

Instruments. The following measures were employed:

1. Locus of Control. To assess the degree of internal locus of control (presumably, the extent to which individuals see outcomes of events in which they are engaged as due to their own instrumentality), the Bialer-Cromwell Children's Locus of Control Scale (Bialer, 1960) was used, with some slight modifications (e.g., substitution of "person" for "kid" in items). Furthermore, for College subjects only, Locus of Control items were alternated with items designed to assess Locus of Evaluation, i.e., the extent to which individuals use themselves for judgemental frames of reference, after a method introduced by J. O. Miller. (1963).

2. Tolerance for Ambiguity. The measure of tolerance for ambiguity was a portion of the Decision Location Test or DLT (Etzel, 1953). Specifically, 2 of the test's original 4 items were used since these had been found by the DLT author and other investigators to be the most reliable. The DLT makes use of series of figures which begin with very sparse cues but which over the series add details until a familiar object is completely recognizable at the end of the series. A subject is individually instructed to try to name the object at any point along the series only if he is "reasonably sure" of what it will look like at the end. Total number of incorrect labels is the score for intolerance of ambiguity for an item. Conversely, a subject is defined as completely tolerant of ambiguity if he never submits an incorrect label for the ultimately identifiable object when he is inspecting restricted ones for that object, i.e., has a score of zero.

3. Achievement Motivation. An "objective" measure of achievement motivation devised by Myers (1964) was modified slightly for inclusion in this project. That is, 3 items which had been deleted from the original measure were re-inserted, for this study, to increase potential inter-subject variability. Subjects were asked to express degree of appropriateness for each statement, from "never true" to "always true." A copy of the modified Objective Achievement Motivation (OAM) scale is attached to this report as Appendix C.

4. Risk-Taking. A game-like technique was devised to assess willingness to take risks. In this approach, subjects were individually asked to trace a star by mirror-drawing, within a time limit of 25 minutes. Each subject was given 50 pennies and told that he would lose a penny every time he crossed the outline of the figure. Further, the subject was told that he could quit the game at any point, and keep what was left of the pennies; also, if the subject successfully negotiated the entire star, he would win a bonus of 35¢, plus whatever was left of the pennies. However, if 50 errors were made, before completion of the figure or if he failed to complete the figure within the time limit, the subject was informed he would "... only get five cents for (his) efforts."

Risk-taking score was calculated as the product of total errors x total time (in secs.) on the mirror-drawing task, i.e., a high score would reflect persistence in the face of many errors and was construed as high-risk behavior, while low scores would reflect early withdrawal and/or few errors, neither of which would suggest risk-taking.

5. Other Measures. In addition to the foregoing, some groups were administered the Meier Art Judgement Test (1940) as a measure of aesthetic judgement, and all subjects were administered the Maze Test (Howard & Diesenhaus, 1965), purportedly a measure of spontaneous behavioral variation which was expected to be related to complexity-choice rate. Also, a crude index of socio-economic status (SES) was based on parents' occupation, and subjects' IQs were based either on data for individually administered tests in case records, (for retarded subjects) or (for non-retarded subjects) on results of the Otis Quick-Scoring Mental Ability Test, Form Gamma.

Procedure. Two to three weeks prior to possible selection as a subject in a complexity-choice experiment, intact classes of high school and college students were administered a schedule of measures including the Otis IQ, Maze Test, Meier Art Judgement Test, Objective Achievement Motivation questionnaire, and a Locus of Control Scale. (As already noted, college students received a combined Locus of Control-Locus of Evaluation Scale.)

Mentally retarded subjects who participated in the 30-item complexity-choice procedure were administered most of the foregoing, with the exception of the Otis IQ and Meier Art Judgement tests, but these subjects were examined individually, one week to 10 days prior to inclusion in a complexity-choice experiment. Tolerance for ambiguity and risk-taking measures were administered immediately after any subject was run on a complexity-choice procedure.

It should be noted that, for these analyses, subjects run on 30-item and on 90-item series were treated together, with complexity-choice rates transformed to percentages. This seemed feasible in view of the high correlations found between various sets of 30 items in some of the studies from which these subjects had been drawn.

Results

Normal-Distribution Cohort. In order to examine for possible interrelationships between measures across the three sampled populations, i.e., MR, HS, and College samples, it was necessary to take into account the disproportionality of IQs at various levels, relative to a normal distribution of IQs, if data for all subjects were included at once. Further, if one wished to consider relationships between the measures for any of the three samples at a time, it was likely that a given correlation would reflect some restrictedness of range in one or both measures being correlated.

McNemar (1955) provides a formula for deriving an estimated uncurtailed correlation coefficient (Rxy) when either x or y in a sample yields a curtailed distribution. This estimate requires knowledge of the S.D. for the uncurtailed distribution of x or y, whichever is curtailed. In order to provide such estimates of S.D.'s for uncurtailed distributions, and further, in order to examine for certain interrelationships between the various measures in a normally distributed sample, a normally distributed cohort with respect to IQ was contrived from available data. Development of this cohort, with N=100, was facilitated by the presence of some subjects in special classes for the retarded whose IQs exceeded IQ 84, but who were otherwise not included in prior analyses. The cohort consisted of 21 subjects culled from the MR sample, 67 HS subjects, and 22 College subjects. Table 33 gives characteristics on several pertinent variables for this special data aggregate.

Table 33.

Characteristics of Special Normal Distribution Cohort (N=100)

	Measure						
	Complexity-Choice (%)	SES	DLT	IQ	CA	OAM	LC
Mean	49.98	3.43	3.67	100.19	16.79	45.30	14.04
S.D.	23.32	1.66	4.47	16.25	1.60	9.88	5.15

The distribution of IQs for the special cohort was examined for normalcy by a Kolmogorov-Smirnov test, and with D=.060, p>.20 with respect to non-departure from normality.

Correlations between complexity-choice and the other measures whose characteristics are summarized in Table 33 were computed, and their coefficients are presented in Table 34.

Table 34.

Correlations Between Percent of Complexity-Choice and Specified Measures in Normal Distribution Cohort.

COMP. CHOICE WITH:	IQ	CA	DLT	LC	OAM	SES
r =	.287*	.025	-.114	-.066	-.262*	.258*

*p < .05

Inspection of Table 34 reveals that, for the special cohort, only three measures are significantly if barely correlated with complexity-choice. In one instance, the correlation between choice and achievement motivation (OAM), the indicated relationship is weak but negative, opposite of expectations.

Correlation coefficients between complexity-choice and various other measures were also computed for each of the three samples. Further, each coefficient was adjusted for curtailment of whichever measure showed greatest restriction in variability relative to the S.D. for that measure in the normal distribution cohort. These coefficients, both unadjusted (r) and adjusted (R) for range, are presented in Table 35.

Table 35.

Correlations With Adjustments For Range Between Complexity-Choice and Other Measures In Each Primary Sample.

		Measure					
Sample		IQ	CA	DLT	LC	OAM	SES
MR	r	-.218	.142	-166	-.099	-.168	.619*
(n=53)	R	-.348	.185	-.116	-.209	-.160	.617
HS	r	.090	-.406*	.269*	-.252*	-.144	.164
(n=67)	R	.175	-.646	.543	-.259	-.137	.176
COLLEGE	r	.199	-.203	.323*	.034	-.291*	.146
(n=57)	R	.433	-.194	.530	.102	-.306	.168

* Significant at or beyond .05

Inspection of Table 35 reveals a number of surprising effects that are opposite to predicted directions. The significant positive correlation between complexity-choice and the DLT for both non-retarded groups suggests that complexity-choice varies with intolerance for ambiguity, rather than the other way around. In effect, to some measurable degree, inclination to seek out novel or incongruous stimuli is related to a distaste for ambiguity, perhaps in the sense that a lack of clarity or of easily assimilated information provokes the individual to pursue such clarity. Conversely, an individual who is tolerant of ambiguity is evidently willing to in effect live with his ignorance.

The small but significant negative correlation between locus of control and complexity-choice in the HS sample, while opposite to predictions, is consistent with findings in a study of "information seeking" by Pines and Julian (1969). In that study, externally controlled subjects made more frequent exposures of complex figures than did internally controlled subjects. Both groups were equally accurate in a task related to the exposed figures. The authors concluded that externally controlled subjects required more evidence in their pursuit of information necessary for subsequent decision-making.

The most striking correlation is that for the MR sample between complexity-choice andSES, with complexity-choice rate increasing with decreased socio-economic status. Thus, middle-class or higher-SES retarded subjects are more likely to reject complexity than their lower-SES peers. What this suggests is that middle-class or higher-SES retardates "understand" the aversive qualities of complex stimuli more easily than lower-SES retardates. While not predicted, this can be interpreted as further confirming the social or learning-theoretic view of aversion to stimulus complexity which has been proposed in this report. That is, it is reasonable to suppose that the consequences of failure, especially in the school context, are amplified if not earlier introduced in the histories of middle-class relative to lower-class retarded children.

Other Measures. Correlations between complexity-choice and several other measures investigated were not different from zero, with one exception. That is, the correlations with the Maze Test, the Meier Art Judgement Test, and the risk-taking measure were at or about .00 for each sample tested. However, the relationship between complexity-choice and locus of evaluation, which had been fortuitously administered to the College sample alone, was considerable, r = .649. That is, the greater the tendency for an individual to use himself as a judgemental frame of reference, the greater his perceptual curiosity. In effect, trusting oneself as appropriately resourceful in decision-making guides one to "take on" at least momentarily perplexing informational contexts.

Relationships with Amount of Material. In view of the low correlations between Dimension B, Amount of Material, and the other dimensions, it was thought that one possible way of checking the validity of complexity-choice for Amount of Material as an appropriate index of perceptual curiosity was to examine its relationship with several selected variables. Therefore, correlation coefficients were computed between Amount of Material percentages and four other measures: OAM, SES, Locus of Control and the DLT. These correlations were run for the normal distribution cohort only. They showed no relationship greater than $r = .182$ (for Amount of Material and the DLT), for which $p > .05$ even for so large a sample. (N=100).

Other Correlations. It is of some interest to consider relationships among other measures, aside from complexity-choice. For example, in the special cohort, $r = .657$ between IQ and DLT. This correlation reflects the marked differences for tolerance of ambiguity between the retarded and non-retarded groups, i.e., average DLT for the MR group = 9.34, while for the combined HS and College groups, average DLT = 1.84. Nevertheless, DLT was unrelated to complexity-choice for MRs, while these measures were slightly but significantly related in both other samples. Incidentally, the sharp increase in coefficients for DLT and complexity-choice in the HS and College samples when curtailed range is considered occurs because of the contribution of the MR group to overall DLT variability.

Also of some interest is an $r = .324$ between IQ and age for the normal distribution sample, which simply reflects the concentration of higher-IQ subjects in the College sample. However, R for IQ and CA in the HS sample alone = -.408, as adjusted for restricted range. In view of the significant relationship between complexity-choice and age for HS students, which reaffirm findings as discussed in Experiment V, the correlation between age and IQ just presented could be troublesome. But when age is partialled out of the correlation between complexity-choice and IQ for the HS sample, the degree of association is barely altered, i.e., $r = -.129$. Therefore, we conclude that the negative relationship between age and IQ in the HS sample is probably a sampling artifact which in no apparent sense explains the inverse effect of age with complexity-choice discussed extensively elsewhere in this report.

Analyses for Curvilinear Effects. The foregoing correlational analyses are of course based on the initial assumption that relationships between complexity-choice and other variables will be linear. However, it is conceivable that complexity-choice bears a curvilinear relationship to certain of the other variables considered.

In that regard, the MR and HS groups were each subdivided according to their complexity-choice rates into three levels, High, Medium, and Low, and results on selected variables were subjected to analyses of variance according to the complexity-choice levels. These analyses were separately conducted for the MR and HS data.

For the HS group as subdivided into complexity-choice levels results on the risk-taking task were strikingly curvilinear, with the Medium sub-group significantly lower ($p < .05$) in risk-taking than either High or Low subgroups, which were equal to each other. That is, both High and Low scorers in terms of complexity-choice were inclined towards high risk-taking, while moderate complexity-choice scorers were likewise moderate with respect to their risk-taking behavior. This result is reminiscent of findings for risk-taking behavior as a function of such other factors as need for achievement (Atkinson, 1958; Atkinson, Bastian, Earl, and Litwin, 1962) and locus of control (Liverant and Scodel, 1960). However, in those studies, it is high need for achievement or internal locus of control that are associated with moderate risk-taking behavior. One possible interpretation in the present context is that high complexity scorers are willing to "risk" engagement of perplexing informational sources, while low complexity scorers are willing to "risk" loss of the opportunity to engage such informational sources.

Results on the Maze Test were also examined by analysis of variance for HS complexity levels. These results were likewise curvilinear, significant beyond the .10 level, in the Medium sub-group higher on the Maze Test $p = .10$) than the Low subgroup, and with the High subgroup lower, but not significantly so, than the Medium subgroup. Other analyses, on SES and locus of control, showed the High subgroup to be significantly lower ($p < .05$) with respect to both of these variables than the Medium and Low subgroups, which were equal to each other in both SES and locus of control.

Similar analyses on MRs leveled for complexity-choice scores showed conflicting results to those for HS students. There were no significant effects ($p > .10$) in risk-taking for MR complexity-choice subgroups, with a slight trend towards an inverse effect, i.e., low complexity scorers being highest in risk-taking, high scorers being lowest in risk-taking. On the Maze Test, results for MRs are closest to the expected effect, with means of 9.55, 4.68, and 5.25 on the Maze Test for High, Medium, and Low complexity-choice levels respectively. Thus, relatively high complexity scorers among MRs are significantly higher ($p < .05$) than either moderate or low complexity scorers on the Maze Test, a measure of stimulus-seeking. The inverse results on the Maze Test between Medium and Low complexity-choice subgroups probably

explains the failure to find a linear relationship for MRs between the Maze Test and complexity-choice. Results for MR subgroups on SES were clearly linear, in accord with the high r discussed earlier, and there were no discernible effects on locus of control for MRs.

Summary

Correlations between complexity-choice rate and various other measures were examined for retarded and non-retarded subjects, as well as for a normal-distribution cohort (with respect to IQ) specially contrived from the data. Most correlations were either zero-level or opposite to predictions. Various explanations were offered for these findings which attempted to reconcile them with predictions. Analyses for curvilinear relationships between complexity-choice and certain other measures explained some failures to earlier find significant linear effects.

VIII. Modification of Perceptual Curiosity Behavior Through Training.

It has been reasonably well established in the foregoing research that community-based educable mentally retarded adolescents are inclined towards low complexity-choice, as predicted. The theoretical position from which these predicted findings are derived holds that retardates are vigilant in the face of new informational contexts, characterized in the foregoing research by complex stimuli. Such vigilance very probably derives in turn from histories of negative experience with learning tasks. Avoidance of new informational contexts is therefore based on the retarded individual's expectancy, generalized from earlier experience, that information in the new context will be unmanageable or non-assimilable i.e., an encounter with the new context will be frustrating and unrewarding.

Now, it is quite conceivable that at least some new information which is avoided by retardates could be assimilated by them, given the motivation to contend or cope with the new context. Since negative affect is a likely consequence of momentary exposure to new information for the retardate, willingness to contend with the sources of new information would require some basis for reversing the typical affective response, i.e., contending with new information must lead to positive consequences. Because the individual cannot acquire evidence that coping with new informational contexts may be intrinsically rewarding, given his inclination to avoid such contexts, it is necessary to prompt such coping behavior by providing extrinsic rewards for it.

Ultimately, positive extrinsic consequences for coping with new information may in turn lead to such behavior in pursuit of more intrinsic objectives, given only that the individual so engaged finds that he can manage or assimilate the new information after all.

The present study was designed to explore the efficacy of training educable retarded individuals to increase their perceptual curiosity behavior. In this study, perceptual curiosity, i.e., complexity-choice, was conceptualized as an operant, ordinarily leading to intrinsic positive consequences, but now leading to positive consequences that are extrinsic in nature. The experiment was designed to consider the effects of alternative reinforcement scheduling, i.e., total or partial schedules, on the acquistion of increased complexity-choice, and on complexity-choice in an extinction series. In a later section of this report, studies of the consequences of such training to other behaviors will be presented.

Method

Subjects. Sixty-four educable retarded adolescents (CA range 15-18, 32 males and 32 females) were selected from a slightly larger group randomly sampled from among students participating in a two-week pre-vocational training program. IQ data were unavailable for these subjects, but all were members of secondary level special classes for the mentally retarded in New York City. Selection of subjects for participation in this study was dependent on complexity-choice rates for 6 items, with rates of 3 or less. About 10% of the original sample exceeded 3 complex choices out of 6, and were excluded from further participation.

Apparatus. The Visual Test Module, used in earlier experiments, was modified to allow for delivery of marbles through a chute into a metal cup, set just below an opening towards the bottom of the surface of the Module facing the subject. Marbles made a substantial noise when they fell into the cup. Delivery of the marbles was automatic, depending on correctness of response and on whether a subject was on a total (100%) or partial (50%) schedule, which was programmed in advance.

Stimuli. Training stimuli consisted of the 90 stimulus pairs employed in Experiment III.1, with 10 pairs selected from among the middle 30 and repeated after the 90th pair. Stimulus pairs were sequenced on a circular tray holding 100 slides. In the absence of additional stimuli, subjects exceeding 90 trials through training and extinction were unavoidably re-exposed to specific stimulus pairs. However, it was also possible in this way to maintain training without interruption.

The first 6 stimulus pairs were those items from each complexity dimension which optimally discriminated between High- and Low-Complex subjects (see Experiment III.2).

Subgroups. The total group of subjects was subdivided into 4 subgroups of 16 subjects (8 males, 8 females) each. Group CT received reinforcement on a 100% schedule for choice of complex stimuli, Group CP received reinforcement for complex choices on a 50% schedule that was randomly sequenced, Group ST was on a 100% schedule with simple choices as the correct response, while Group SP was on a 50% schedule for simple choices. Members of the latter two subgroups, included for control purposes in the present study and for subsequent studies of transfer effects of training, were matched to criterion with subjects in the former subgroups. That is, each subject in Group ST was run to the same number of trials as some subject in Group CT, and a similar procedure was followed between members of Groups SP and CP. This assured an equal number of trials between the respective experimental and control groups.

Procedure. All subjects were given the following introductory instructions: "I'm going to show you some pictures, two at a time. They will appear here (demonstrate) in these windows. The two pictures will stay on for a few seconds, then go off. When they go off, you get a chance to see one of the two pictures some more by pressing one of these buttons. If you want to see the picture on the left, press this button on the left. If you want to see the picture on the right, press this button on the right. You can only see one of the pictures some more, so you have to decide, while the pictures were on together, which one you want to see more of, the one on the left or the one on the right. You must wait for the pictures to go off before you press a button. Then, as long as you hold the button in the picture will stay on. When you let go, a new pair will come on, and you must decide again. Do you understand? Each time a pair of pictures come on, decide which of the two pictures you want to see some more. Then, when the two pictures go off, press the button under the one picture you want to see, and that picture will come on right away. Okay? Let's begin."

Subjects were then run on the 6 best-discriminating items. As noted earlier, subjects who exceeded 3 complex choices were then excused from the experiment.

All subjects with 3 or fewer complex choices were at this point assigned to Groups CT, CP, ST, or SP. Assignment to ST or SP followed immediately after another subject had been run in the CT or CP conditions. In addition, subjects were alternately assigned to one of two "back-up" reinforcement conditions, Experiential or Consumable. Experiential back-up rewards were tickets to a major sports event or to a first-run movie. Consumable back-up rewards were prepaid dinners at a medium-range restaurant.

Instructions continued as follows:

"Now, from here on out, you will have a chance to earn a very good prize, depending on how you do.

Your prize will be (a free dinner at a New York restaurant) (a free ticket to a professional hockey or basketball game, or a downtown movie). (Where would you rather eat, at _____ or _____?) (What would you rather eat, at _____ or _____?) What would you rather see a hockey game at Madison Square Garden, a basketball game at the Garden, or a movie and show at Radio City Music Hall?)

Okay, every time two pictures come on, you make a choice. If, you make the correct choice, AND if you hold it on for a long enough time, you may get a marble through that hole, into that cup. At the end, if you have enough marbles, you will earn a very good prize. Remember: to get the marble, you must make the correct choice, for the right amount of time. Do you understand? Any questions? Do the right thing often enough and you'll win (a free dinner at _____) (a free ticket to _____.)"

As noted in the instructions, correctness of a response was contingent on choice and on the subject holding the appropriate choice for a duration of 5 seconds or more. This latter contingency was introduced in the hope that subjects might thus be more inclined to actually explore their choices.

Criterion for training was 14 correct out of 18 successive trials. Immediately, upon achievement of criterion, the reinforcement circuit was disconnected and the next 15 trials were administered under extinction. Rewards were given independent of the actual number of marbles acquired, but this was not known to subjects.

If a subject failed to achieve criterion by Trial 66, the apparatus was switched off, and the subject was asked:

"You don't have many marbles, do you? Do you remember what you're supposed to do? You have to make the correct choice, and hold it on for the right amount of time. Maybe you aren't doing those things. Okay, we'll start again."

If, in 10 further trials, the subject showed no indication that he had caught on to the task, he was again interrupted:

"Maybe you're picking the wrong picture. Maybe you're not holding the picture on for a long enough time. Maybe you should start picking different pictures and holding them on longer. That way, you might get more marbles."

Finally, if the subject still failed to show learning by Trial 86, he was interrupted as follows:

"Which pictures are you picking? (Subject answers.) Oh, (the prettier ones) (the ones that look okay) (etc.?) Well, you probably should try to pick the other ones, and hold them on for a long enough time. That way, you're sure to get enough marbles to win your prize."

Few subjects required this final prompt, and none required prompting beyond it.

Results

An initial analysis of training data was conducted with respect to trials-to-criterion. In this analysis, although Groups ST and SP had been matched on trials-to-criterion with Groups CT and CP, data for actual achievement of criterion for the two control groups were considered. A three-way factorial analysis of variance, with Complex vs. Simple Choice as Correct, Total vs. Partial Reinforcement, and Experiential vs. Consumable Reward as the 3 factors is summarized in Table 36.

Table 36.

Analysis of Variance for Trials-To-Criterion in Curiosity Training as Function of Reinforcement Schedule, Correct Response, and Back-Up Reward.

Source	df	ms	F	F.95
Schedule (A)	1	702.25	< 1	4.01
Response (B)	1	20808.06	24.27	
Reward (C)	1	22.56	< 1	
AB	1	169.00	< 1	
AC	1	400.00	< 1	
BC	1	885.07	1.03	
ABC	1	1849.00	2.15	
error	56	857.03		

It is immediately evident upon inspection of Table 26 that only one factor, Complex vs Simple Choice as Correct (Factor B) is significant, actually well beyond the .001 level. It took subjects for whom complex choices were correct an average 69.56 trials to criterion, while subjects for whom simple choices were correct, doing "what comes naturally," took an avergae 33.50 trials to criterion. Of the ST and SP groups combined, 40.6% achieved criterion in 18 or fewer trials. Only one subject of the 32 in the CT and CP groups combined achieved criterion in as few as 18 trials.

Clearly, neither reinforcement schedule nor reward condition were potent factors in acquisition. While the question of back-up reward was added out of little more than interest, it had been expected on the basis of a substantial literature that subjects under the 50% schedule would take longer to achieve criterion than subjects under 100% reinforcement. The means for the contrasting schedules are in the right direction, with average trials-to-criterion for 100% subjects = 48.21, and that for 50% subjects = 54.84, and this trend is consistent within Complex-Correct and Simple-Correct groups. But these results are not significant.

In further pursuit of the possible differential rate of reinforcement schedules, complexity-choice data for 15 trial blocks, 6 trials per block, were analyzed for the subgroups. In this analysis, data for some subjects were extrapolated, beginning at Trial Block 4, with increasing amounts of extrapolation beyond Block 4. That is, since subjects achieved criterion at varying points, a fictitious "perfect" score (6 for CT and CP, 0 for ST and SP) was inserted in any trial block beyond the one in which criterion was achieved by a given subject. The analysis summarized in Table 37, along with Figure 11, which presents these data graphically, essentially only dramatizes the effects of the training, and must be viewed very cautiously.

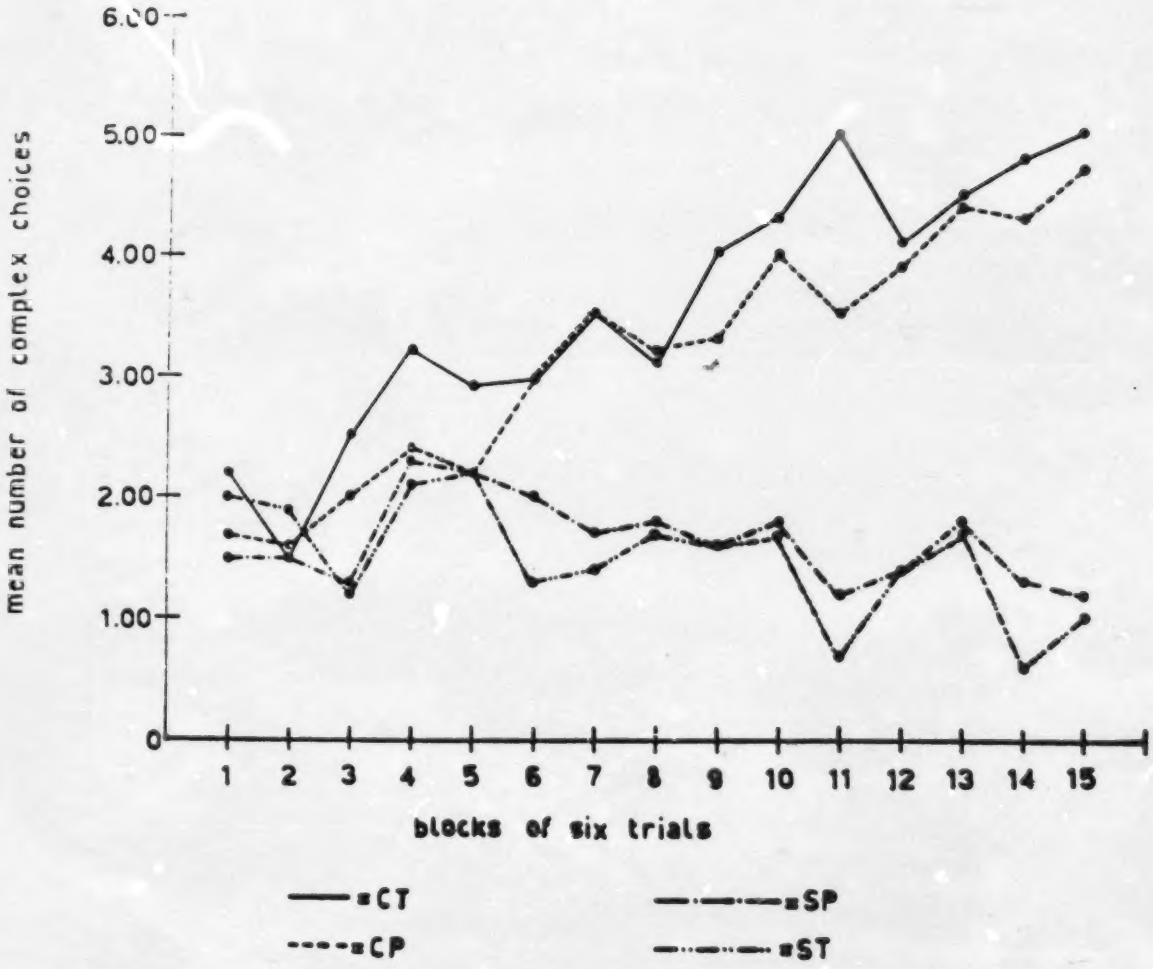


Figure 11.
Complexity-choice rates as a function of varying training conditions.
-96-

Table 37.

Analysis of Variance of Complexity-Choice For 15 Acquisition Trial Blocks (6 Trials Per Block) As Function Of Correct Response and Reinforcement Schedule.

Source	df	ms	F	F.95
Response (B)	1	752.64	68.48	4.00
Schedule (C)	1	3.54	<1	
BC	1	17.57	1.59	
error (b)	60	10.99		
Trial Blocks (A)	14	12.58	32.25	1.71
AB	14	26.35	67.56	
AC	14	.94	2.41	
ABC	14	67.56	173.23	
error (w)	840	.39		

In Table 37, neither the main effect for Schedule nor its interaction with Complex vs. Simple Response Correct are significant. However, all other effects are highly reliable. A breakdown of this analysis into its everal component subanalyses, shows, for one, not a single trial block where 100% vs. 50% schedules yield reliable differences, i.e., with $p < .05$. However, and quite coincidentally, differences at Trial Block 1 between 100% and 50% combined groups are significant at the .10 level. That is, there are marginal effects at the baseline block, before training begins.

Because of this marginal effect, an additional analysis was run over the first of trial blocks, with minimal extrapolation, for 8 subjects in each group who were matched on base rate (Mean = 2.00 on Trial Block 1). This analysis is summarized in Table 38.

Table 38.

Analysis of Variance of Complexity-Choice Over 7 Acquisition Trial Blocks for Matched-To-Baserate Subgroups.

Source	df	ms	F	F.95
Response (B)	1	52.07	5.39	4.20
Schedule (C)	1	3.49	<1	
BC	1	.64	<1	
error (b)	28	9.66		
Blocks (A)	6	2.51	<1	2.09
AB	6	7.29	<1	
AC	6	.90	<1	
ABC	6	.86	<1	
error (w)	168	49.50		

As indicated in Table 38, when groups are matched on base rate, only Complex vs. Simple Response Correct is significant, and all other effects are virtually ruled out. Thus, the lack of effect of differential schedule with regard to acquisition in this study is quite conclusive. It should be further noted that there is no significant effect for Trial Blocks so that, with matched groups, there is no convincing evidence of differential acquisition over the first 36 training trials, except for the gross Correct Response effect.

However, analysis of simple effects for groups as originally constituted over 15 trial blocks (as shown in Figure 11), yields a steady if gradual increase in complexity-choice rate for both CT and CP groups. At the same time, ST and SP groups are essentially stabilized rather soon, and occasional significant differences between trial blocks for these groups are of small magnitude.

Extinction. While reinforcement schedules did not yield differential acquisition effects, it was still possible that they would be reflected in terms of extinction. But further, because of the nature of the training, a rather complex prediction can be made, based on the following. In a study by James and Rotter (1958), some subjects were set to approach a task with instructions that the outcome of the task would be independent of their skill, i.e., a function of chance, while other subjects were told that the quality of their performance was dependent on their skill with the task. Half of the subjects in each group were on a 50% schedule of reinforcement, while the other half were on a 100% schedule. James and Rotter found that the classical extinction effect, greater resistance under a partial schedule, only obtained with chance-oriented subjects. For skill-oriented subjects, the opposite occurred: subjects under the 100% schedule were more resistant to extinction. That is, under skill conditions, an extinction series was less credible to subjects under 100% from 50% reinforcement.

In the present study, subjects who were reinforced for simple choices could be viewed as being rewarded for effortless performance, i.e., doing what they would tend to do in the absence of reward. But this is not the case for subjects who were reinforced for complex choices. Here, real effort, including a countermanding of disposition to respond otherwise, was required. A parallel might be drawn between the role of effort and of skill. It would then be predicted that results for this study would be consonant with those for James and Rotter: greater resistance to extinction under 50% reinforcement only for Simple-trained subjects, and the opposite for Complex-trained subjects.

Performance over 15 extinction trials was divided into 3 blocks of 5 trials each. These blocks were then analyzed according to Complex vs. Simple Correct Response and Schedule. This is summarized in Table 39. Figure 12 presents these extinction effects graphically.

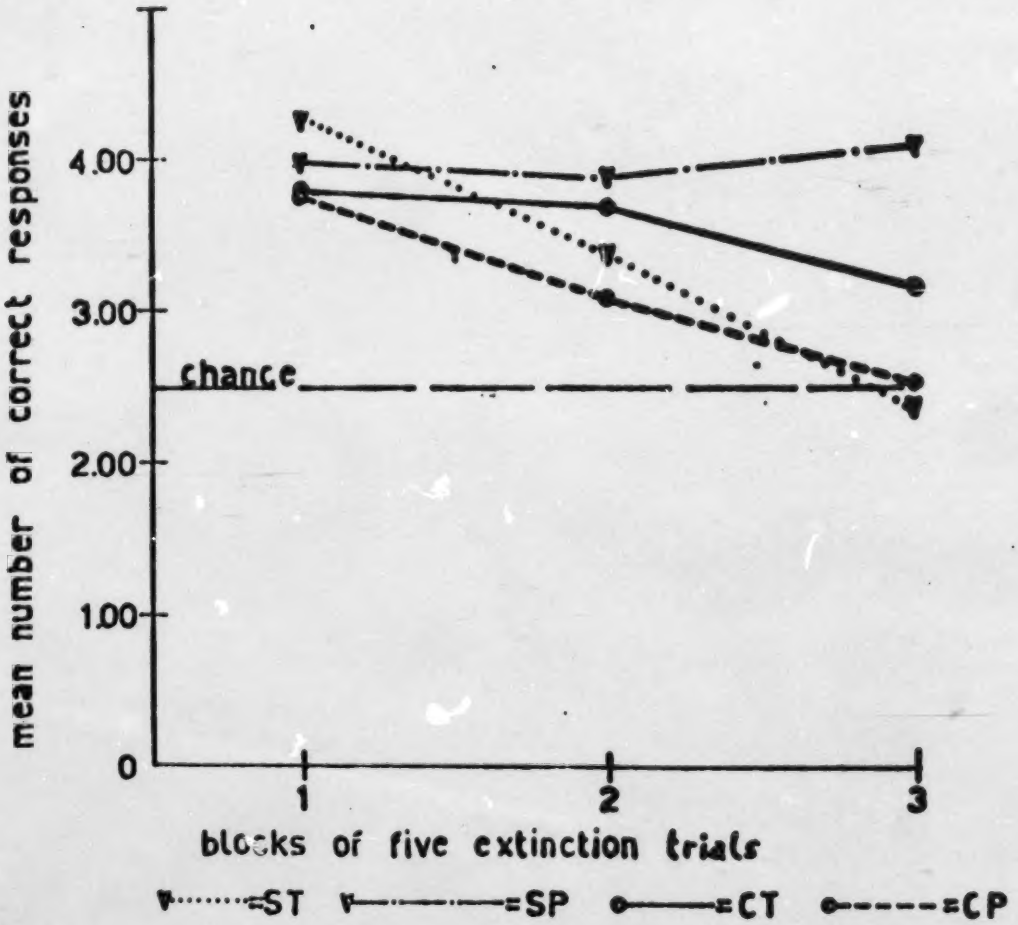


Figure 12.
Correct response rate during extinction as a function of prior training condition.

Table 39.

Analysis of Variance of Reinforced Responses Under 3 Blocks Of Extinction Trials (5 Trials Per Block) As Functions Of Correct Response and Reinforcement Schedule During Acquisition.

Source	df	ms	F	F.95
Response (B)	1	3.42	2.87	4.00
Schedule (C)	1	.33	<1	
BC	1	16.44	13.81	
error (b)	60	1.19		
Blocks (A)	2	17.10	53.43	3.07
AB	2	.27	<1	
AC	2	.85	2.65	
ABC	2	6.86	21.43	
error (w)	120	.32		

The highly significant Blocks x Response x Schedule interaction is illuminated by the means per trial block for each group, presented in Table 40.

Table 40.

Mean Correct Response Rate Under Extinction on 3 Blocks (5 Trials Per Block) For Subgroups.

	Trial Blocks			
Group	I	II	III	Total
CT	3.93	3.81	3.25	11.00
CP	3.93	3.18	2.37	9.50
ST	4.25	3.37	2.43	10.06
SP	4.06	4.00	4.00	12.06

The results presented in Table 40 are supportive of the hypothesis. Group SP maintains a high level of "correct" (simple-choice) response throughout extinction, while Group ST shows a significant drop, towards about chance, at Block III. It is interesting to reflect on this as a possible incursion towards complexity-choice, a greatly delayed novelty effect, perhaps. On the other hand, it is Group CT which, while dropping slightly, is more resistant to extinction than Group CP.

Across all 15 extrinction trials, while there are differences between the groups, all groups on the average are responding correctly at a level higher than chance. It is reasonable to conclude, therefore, that the training of perceptual curiosity in the present context, while tedious in some instances, can be accomplished, and its effects are generally maintained in the absence of extrinsic support.

Summary

Two groups of MR subjects, one on a 100% reinforcement schedule and the other on a 50% schedule, were trained to increased perceptual curiosity, with complex choices held in for 5-sec. or more as the operants. Two MR control groups, one on a total and the other on a partial schedule, were reinforced for simple choices and subjects in these groups were each matched with an experimental subject's trials-to-criterion (14 correct out of 18 successive trials) and run to that number of trials. However, actual trials-to-criterion for control subjects were noted. Fifteen extinction trials were added after criterion (or matched criterion in the case of controls). Control groups achieved actual criterion significantly earlier than experimental groups. There was no effect of reinforcement schedule in acquisition, but there was a significant interaction between correct response during training and reinforcement schedule for extinction data.

IX. Transfer of Perceptual Curiosity Training to Subsequent Tasks.

While general characteristics of perceptual curiosity in adolescents have been examined, and while the efficaciousness of a training procedure for modifying perceptual curiosity behavior in retardates has been established, the empirical implications of those characteristics examined and of the training are unclear. This is especially so in view of the absence of strong associations between complexity-choice and other variables, as explored in Section VII.

The present study considers transfer of perceptual curiosity training to other realms of behavior, and is therefore in part a way of further testing the validity of complexity-choice, i.e., in respect to subjects for whom complexity-choice has been made extrinsically rewarding. If something more than a kind of sham behavior was shaped in Experiment VIII, subjects who were trained to increase their complexity-choice rates can be expected to show the consequences of such training in several ways. For one, subjects who were reinforced for complexity-choice should show a greater readiness than subjects who were reinforced for simple choice to respond to intrinsic reinforcement. For another, complex-trained subjects, who were obliged during training to shift markedly from favored modes of responding, should show greater readiness towards a task requiring flexibility in response. Similarly, complex-trained subjects may be expected to show greater persistence on a difficult task than simple-trained subjects. Finally, if greater curiosity has been aroused by training, this should be reflected in greater interest in new, relatively remote information.

The foregoing possibilities were explored with respect to three tasks. The first task involved discrimination learning, much as the training itself was a kind of discrimination learning task. In the transfer task, correct responses were reinforced by an opportunity to bring an ambiguous figure into greater visual clarity. It was reasoned that Complex-trained subjects would be relatively more motivated in this task because they would be more curious about the figure than Simple-trained subjects. This approach was modelled after a study by Mittman and Terrell (1964), who found that children given the incentive of completing a dot figure made fewer discrimination learning errors than children for whom a completed dot figure was already in view.

A test of increased flexibility as a function of training also makes use of the discrimination learning approach. In another training session, half of the subjects had to reverse or shift to a formerly incorrect class of response. Complex-trained subjects were expected to accommodate these reversals more easily than simple-trained subjects.

Persistence in the face of a difficult task as a function of training was studied by permitting differentially trained subjects to work a complex Chinese puzzle for as much time as they wished. It was expected that Complex-trained subjects would spend more time on the Chinese puzzle than Simple-trained subjects. Interest in remote information was tested by means of a specially prepared questionnaire which asked subjects whether they would be more interested in learning about relatively familiar vs. relatively remote facts. Once again, it was predicted that Complex-trained subjects would exceed Simple-trained subjects in expressed interest in remote information.

Method

Subjects. Of the 64 subjects involved in the training study (Experiment VIII), 56 subjects (28 in each major training group, but unequal numbers with respect to partial vs. total reinforcement conditions) were available for the complete transfer series. However, all of the original 64 subjects were available for some of the transfer tasks.

Tasks. For discrimination learning, a series of three types of problems were designed, with shape, color, and size varying on alternate problems. Each problem was presented 6 times successively, with the position of the correct discriminandum varying with each presentation. The order of types of problems was random. For each problem, there were three choices, e.g., for shape: square, circle, and star; for color: red, green, and yellow; for size: large, medium, and small triangles. There were 3 representative problems for each type in a training session, and with 3 types of problems and 6 presentations per problem, there was a total of 54 trials per session. In any new representation of a type of problem within a session, the same discriminandum which had been formerly correct was again correct.

For the second session of discrimination learning, similar types of problems were designed, but different geometrical figures and colors were employed relative to those used in the first session.

The reinforcement method used in the discrimination learning task consisted of a projected slide which, when in focus, produced a simulated newspaper headline reading "NAKED WOMAN FOUND IN TRUNK OF CAR". However, the projection was initially out of focus. The automatic focusing device of the slide projector was circuited to a timer which, when started, moved the projected headline into sharper focus. Precisely 30 steps on the timer were necessary to achieve perfect focus. The timer was controlled by a telegraph key which was in easy access to a subject.

For the persistence task, a small wooden Chinese puzzle, which when assembled formed a sphere, was employed.

The measure of interest in remote information made use of a forced-choice questionnaire, a copy of which is attached to this report as Appendix D. This questionnaire is loosely modelled after a method by Teeter, Rouzer, and Rosen (1964).

Procedure. Seven days after participating in training, a subject was returned to the laboratory and initially presented with the Chinese puzzle. He was first shown the puzzle in assembled condition, but it was quickly disassembled in his view, and he was

told: "I'd like you to try to put this together. You can work on it as long or as little as you want--quit any time you wish." Actually, subjects were interrupted at 15 minutes if they had not quit the task by then.

Second, the Remote Information (RI) Questionnaire was administered interview fashion.

Next, the discrimination learning task was administered, with the following instructions: "I'm going to show you some cards, one at a time. There are three things on each card. Your job is to figure out which one of the three things is correct on each card. At first, you have to guess, but then, you must concentrate and really figure it out."

"The way you will find out if you are correct or not is this: We're going to project a slide over there. The slide will be badly out of focus, all blurred, so you will not be able to tell what is on it. However, each time you are correct on a card, you will be permitted to press this key, which will move the slide a tiny bit towards better focus. The more you are correct on the cards, the closer and sooner you will get to a clear picture of the slide. Do you get it?"

"One more thing: You will not be able to finish this job today. We will get together again tomorrow or the day after. Today, after you get a certain number of the cards correct, and you have been allowed to press the key a certain number of times, you will be on your own. That means that you will not be permitted to press the key, and nobody will tell you if you are correct or not on the rest of the cards today. Do you understand? Any questions?"

The subject was then administered the discrimination items. Each of the first 15 presentations that was correctly discriminated was reinforced with the instruction, "press the key". Fifteen correct responses could theoretically occur within only 3 problem sets, there being 6 presentations per problem set. Immediately after the 15th correct response, the subject was told: "No more presses -- you're on your own". He was then continued for the remainder of the 54 trials. Post-criterion responses were recorded, as was the total time on the task. After the 54th trial, the subject was told: "We'll get together again tomorrow. You will be able then to get a clear picture of what is on the slide."

On Day 2 of discrimination learning, subjects received the following instructions:

"Today, we will finish what we started yesterday. Once again, I'm going to show you some cards. Again, you must figure out which one of the three things on a card is correct. Remember to concentrate and work carefully."

"Just as we started yesterday, when you're right on a card, you will get to press the key to bring the blurred picture into focus. The picture is now where you left it the other day. Today you will get to see clearly what it is."

"Also, once you have brought the picture into focus, you will go on with the rest of the cards. There will be no reason to press the key. At that point, you will be on your own. Once you have made enough presses for being correct and brought the slide into focus, nobody will tell you whether you are right or wrong on the rest of the cards. Okay? Any questions?"

Once again, pre- and post- criterial performance were recorded, as well as time on the task.

Results

Discrimination Learning: Day 1. If perceptual curiosity training has a facilitative effect in a learning task with opportunity to explore an ambiguous stimulus as an incentive, then a straightforward prediction for the first day of discrimination learning is that Complex-trained subjects should show fewer errors to criterion than Simple-trained subjects. Complex-vs. Simple-Response as Correct during training, as well as Reinforcement Schedule during training, were the two factors considered in an analysis of errors to criterion (15 correct responses) for Discrimination Learning, Day 1. Data for only those subjects who participated in both ways of the discrimination learning task were included in this analysis which is summarized in Table 41.

Table 41.

Analysis of Variance For Errors To Criterion On First Day of Discrimination Learning, As Functions Of Correct Response and Reinforcement Schedule During Training.

(N=56)

Source	df	ms	F	F.95
Response (A)	1	.1694	4.94	4.01
Schedule (B)	1	.0000	<1	
A x B	1	.0029	<1	
error	52	.0343		

As indicated in Table 41, there is a significant effect for class of Correct Response (A) during training on the first day of the discrimination learning task. However, inspection of the pertinent data reveals that the direction of differences due to response during training is opposite to that predicted. That is, Complex-trained subjects make significantly more errors (Mean rate= .509) toward criterion than Simple-trained subjects (Mean rate= .400). The same inversion of predicted effect occurs on error rates after criterion is achieved, a test of the extent of learning on the discrimination task since there is no post-criterion feed-back to the subject. Here, there is an $F=4.65$ ($p < .05$) for the Response factor, reflecting average post-criterion error rates of .482 and .347 for Complex- and Simple-trained groups, respectively. Once again, for post-criterion error, there are no significant effects of total vs. partial reinforcement during training.

The surprising significant inferiority of Complex- compared to Simple-trained subjects on the discrimination learning task certainly requires explanation. This result is perplexing until one considers the possible role of the nature of the discrimination learning task relative to complexity-choice training. During training, Complex-trained subjects were obliged to choose relatively complex stimulus pair members. Presumably, the 5-sec. exposures for choices required as a criterion for reinforcement encouraged Complex-trained subjects to examine their choices. Further, it is conceivable that these subjects at least attempted some classification of the attributes of complex stimuli, no matter how cognitively taxing this might have been.

Now, in the discrimination learning transfer task, the attributes of the task items can be construed in relatively simple terms, i.e., unambiguous variations in shape, size, or color. However, if Complex-trained subjects tried to conceptualize attributes of complex stimuli during training, it is conceivable that they may have behaved similarly towards the relatively simple discrimination learning items. That is, Complex-trained subjects may have hyperideated on the discrimination learning task, by excessive reflection on each item and by contriving complex solutions, e.g., "the large figure is correct when it's in the middle, but it's wrong when it's on the left." Such hyperideational problem-solving behavior was characteristic of IQ-bright relative to IQ-average children in a study by Osler and Trautman (1961), where bright children did more poorly on a simple concept formation task than did average children. Osler and Trautman had predicted that effect because they expected bright children to be more facile in hypothesis testing and presumably richer in available hypotheses. Similarly, Complex-trained subjects in the present study were required to develop hypotheses during training to accommodate criterial

demands, while simple-trained subjects during training were required to merely stabilize a response tendency that was hierarchically prominent.

Tangential support for the notion that Complex-trained subjects were more reflective in their approach to the first day of the discrimination learning task is provided by an analysis of total time over the 54 trials for the respective training groups. An analysis of variance showed only a main effect for Complex-vs Simple-trained groups, with $p < .10$. Complex-trained subjects took an average 6.4 minutes over all first-day trials, while Simple-trained subjects took an average of 5.1 minutes over all trials. These results, while only marginal, do suggest that Complex-trained subjects may have spent the additional time on the task considering excessive "solutions" to the various discrimination problems.

Discrimination Learning: Day 2. On the second day of discrimination learning, formerly inappropriate responses were correct for half of the subjects (Shift condition), while for the other half, Day 1 responses continued as correct (Nonshift condition). Pre- and post-criterion error rates for Day 2 were independently analyzed, taking Correct Response during training and Shift vs. Nonshift into account, but further, Day 1 error rates were covaried in these analyses.

With respect to pre-criterion error rates, an analysis of covariance on Day 2 adjusted for Day 1 data yielded an $F=7.34$, which with 3 and 51 df, $p < .001$. Scrutiny of adjusted Day 2 means, which are pictured in Figure 13 along with the unadjusted means for Days 1 and 2, showed that Simple-trained subjects who were shifted in discrimination responses had significantly more pre-criterion errors than Simple-trained but nonshifted subjects. However, there were no differences as a function of Shift vs. Nonshift for Complex-trained subjects. That is, Complex-trained subjects had no more difficulty shifting to a new class of responses than if the correct responses were the same as on the previous day. Furthermore, Complex-trained subjects under Shift were not significantly different on Day 2 pre-criterion error rates, with Day 1 rate taken into account, than Non-shifted Simple-trained subjects. Thus, as predicted, Complex-training appears to have facilitated the flexibility of retarded learners in a discrimination learning task.

Unadjusted means for Day 1 and Day 2 post-criterion error rates, along with Day 2 means as adjusted for Day 1, are shown in Figure 14. An analysis of covariance for Day 2 post-criterion error with Day 1 covariel yielded an $F=6.10$, which as a p value $< .01$ with 3 and 51 df.

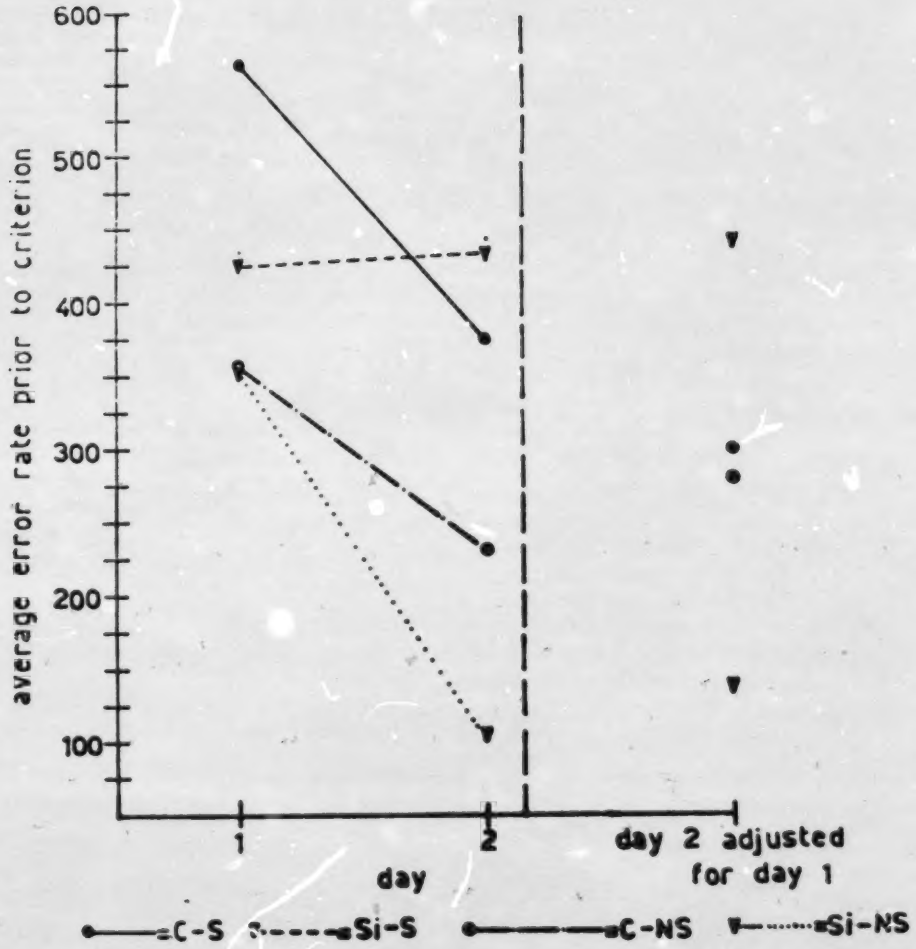


Figure 13.
Pre-criterion discrimination learning error dates on Days 1 and 2, and Day 2 adjusted for Day 1, in variously trained groups.

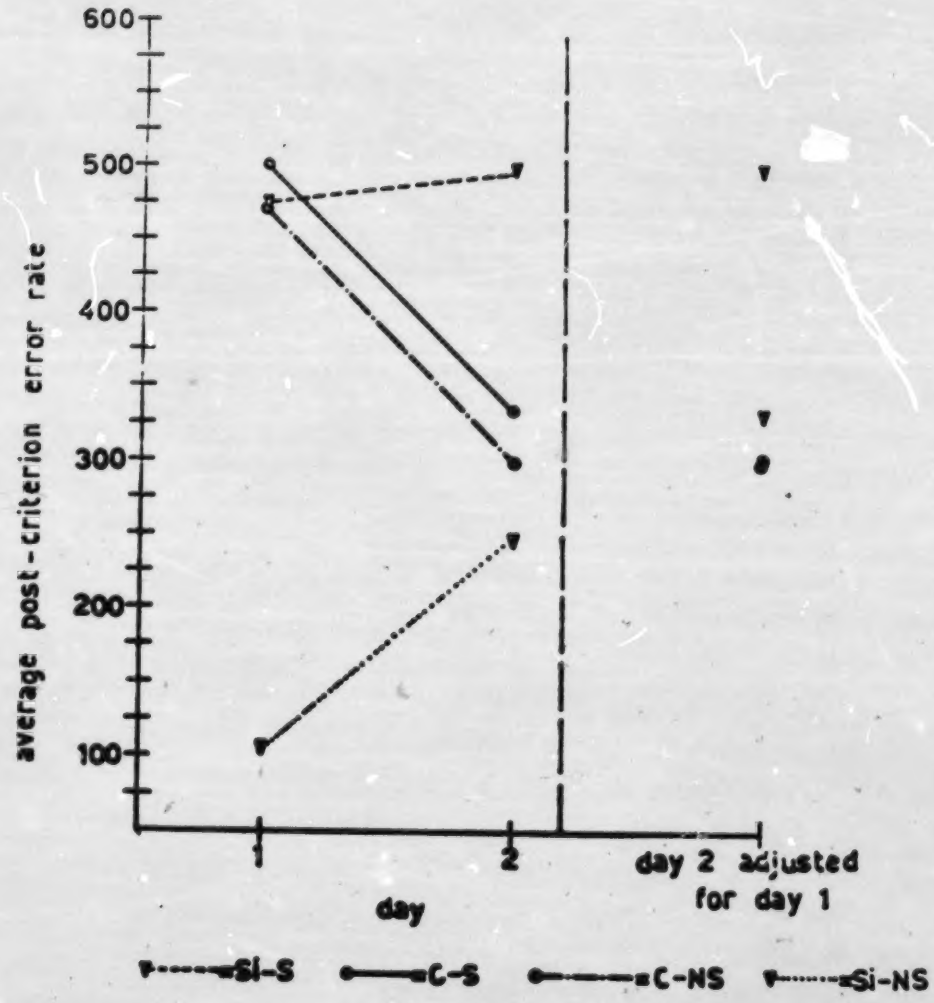


Figure 14.
Post-criterion discrimination learning error rates on Days 1 and 2, and Day 2 adjusted for Day 1, in variously trained groups.

In this case, Shifted and Nonshifted Complex-trained subgroups were equal in post-criterion Day 2 error rates, as adjusted for Day 1. Similarly, Shifted and Nonshifted Simple-trained subgroups did not differ. However, a comparison of Simple- and Complex-trained subgroups who were shifted in response showed that the Complex-trained subgroup had significantly fewer post-criterion errors than the Simple-trained subgroup, with $p < .05$. A similar effect obtained for Complex- and Simple-trained subgroups who were not shifted, except that the difference for these subgroups was marginal, i.e., $< .10 \quad p > .05$. In general, Complex-trained subjects on Day 2, after the criterion is achieved, when Day 1 error rate is taken into account, show learning effects, i.e., in the absence of feedback, that are superior to those for Simple-trained subjects. Thus, not only does complexity-choice training enhance the flexibility of retardates in a learning task, but it appears to enhance task achievement as well, in the long run.

When the total time over 54 trials on Day 2 were examined in a factorial analysis of variance, with Complex vs. Simple training and Shift vs. Nonshift as the factors, there was a significant interaction ($F = 4.79$, $p < .05$ with 1 and 52 df). Examination of subgroup means showed that Complex-trained subjects who were shifted spent significantly longer than all other subgroups, which equalled each other. Simple-trained subjects who shifted did show a similar but marginal ($< .10 \quad p > .05$) effect with regard to Simple-trained but nonshifted subjects. It is interesting that in the presence of familiar response requirements, Complex-trained but nonshifted subjects do not spend undue time on the task. It can be additionally noted that all subgroups spent significantly less time on Day 2 compared to Day 1, but this is a natural consequence of such factors as time for instructions and general adaptation to the task.

Puzzle Task. A factorial analysis of variance for time on the Chinese puzzle task, with Correct Response during training and Reinforcement Schedule during training as the factors was possible for all 64 subjects who participated in training. This analysis is summarized in Table 42, and results are also presented graphically in Figure 15.

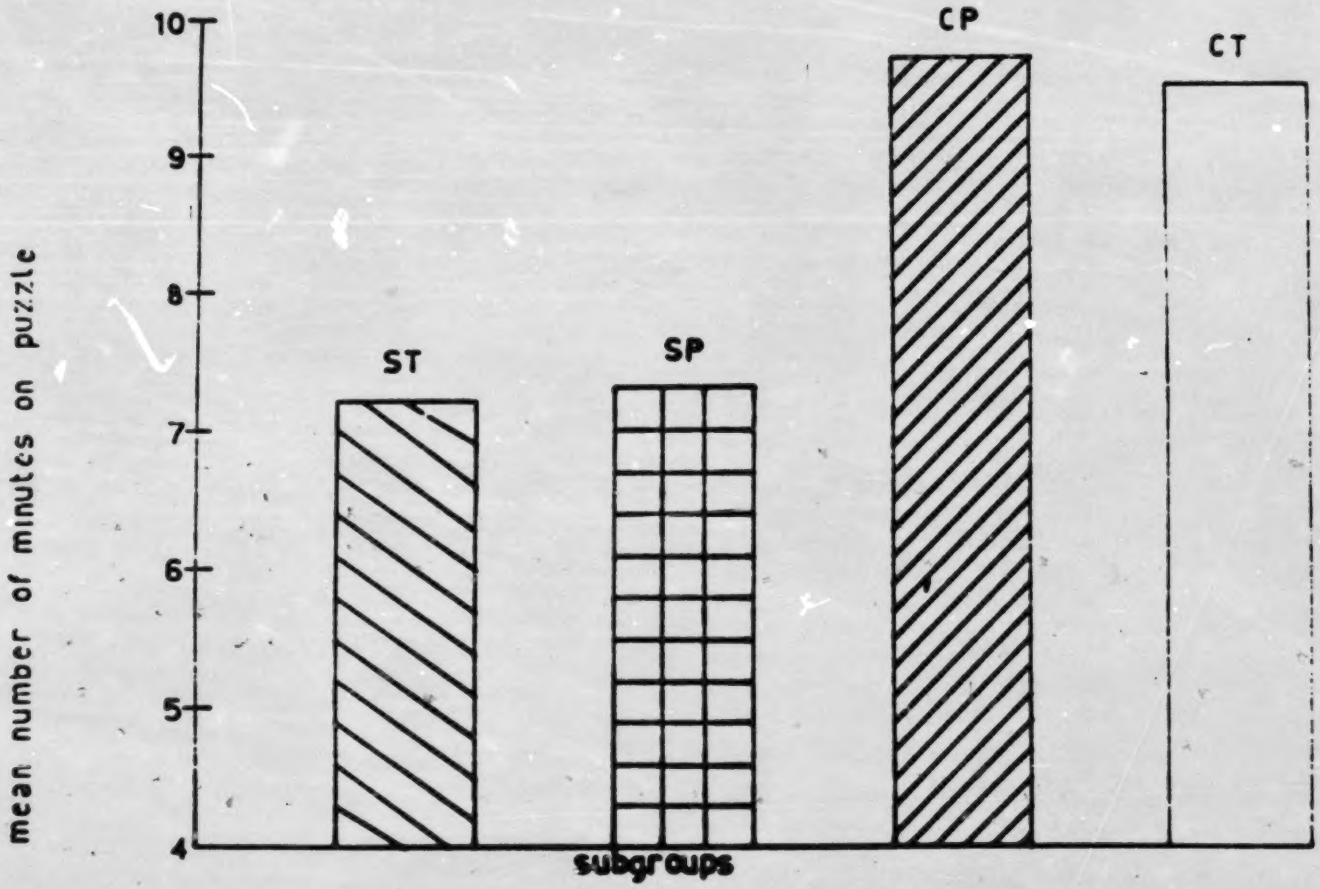


Figure 15.
Time on puzzle as measure of persistence for variously trained groups.

Table 42.

Analysis of Variance of Time on Puzzle Transfer Task As Function of Correct Response and Reinforcement Schedule During Training (N=64)

Source	df	ms	F	F.95
Response (A)	1	337996	6.21	4.00
Schedule (B)	1	534	<1	
AB	1	386	<1	
error	60	54367		

As shown in Table 42, the only significant effect is with respect to Correct Response during Training. Here, as predicted, Complex-trained subjects showed significantly more persistence than Simple-trained subjects, with an average time on the task of 8.57 mins. for the Complex-trained group, and an average of 6.41 mins. for the Simple-trained group.

Test of Remote Information. A factorial analysis of variance similar to the immediately foregoing one was performed on scores for the Remote Information (RI) questionnaire. This analysis is summarized in Table 43.

Table 43.

Analysis of Variance of Remote Information Questionnaire Scores as Functions of Correct Response and Reinforcement Schedule During Training (N=64)

Source	df	ms	F	F.95
Response (A)	1	17.25	3.09	4.00
Schedule (B)	1	1.56	<1	
AB	1	3.56	<1	
error	60	5.58		

No effects on the RI are significant at or beyond the .05 level. Results are roughly in the predicted direction, with a mean RI = 9.50 for Complex-trained subjects, and a mean RI = 8.37 for Simple-trained subjects. However, in the absence of .05 level significance, the hypothesized transfer effect of perceptual curiosity training on increased interest in remote information is viewed as not confirmed.

Summary

The transfer effects of perceptual curiosity training were studied with reference to three tasks: discrimination learning, a measure of persistence, and a measure of interest in remote information. The discrimination learning task involved two sessions, and for some subjects, a formerly inappropriate response became appropriate for the second session. Opposite to predictions, subjects trained to increase perceptual curiosity did more poorly than controls on the first day of the discrimination learning task. This was interpreted as due to the interference of hyperideation resulting from training. As predicted, curiosity-trained subjects showed greater flexibility than controls in the face of shift of responses from inappropriate to appropriate. Also as predicted, subjects whose perceptual curiosity was presumably enhanced by training showed more persistence than controls. A prediction of increased interest in remote information as a consequence of curiosity training was not confirmed.

X. Implications of Findings for Increased Understanding and Educational Facilitation of the Mentally Retarded

The research findings which have been reported in the foregoing pages confirm in yet another context the pernicious effects of a generalized expectancy for failure which other earlier research (e.g., Cromwell, 1963) has found so characteristic of the mentally retarded. But the present findings have extended that older notion, along with some derived from other research, in several ways. For one, the present research shows that expectancy for failure can be manifested at the very earliest stages of involvement with a task. Surprisingly little information is necessary for a retardate to recognize the aversive qualities of certain classes of stimuli. Second, the social learning-theoretic concept of failure expectancy has been extended here to incorporate its role in the systematic rejection of new information by a retarded learner. That is, the expectation that any effort to cognitively engage new information will be thwarted apparently leads

the retarded learner to avoid initial opportunities to consider the potential sources of that new information. Third, earlier findings of aversion to stimulus complexity in institutionalized educable retardates have been generalized here to incorporate community-based retardates at the educable level. The major significance of this extension is that it allows the generality of those earlier findings to educable-level retardation where it is found in greatest numbers, i.e., the community, among special class members.

The tendency to avoid stimulus complexity by retarded adolescents has been found here to be strikingly systematic, e.g., without qualification by such factors as sex or age (the latter qualifying the perceptual curiosity behavior of normal-IQ adolescents). It is tempting to conclude that the lack of perceptual curiosity in adolescent educable retardates represents a qualitatively distinctive class of behavior for this group. But there are exceptions (about 10% of retardates tested) as well as findings of sufficient variability among retardates to degrade that notion.

In a sense, systematic avoidance of stimulus complexity can be thought of as adjustive for retardates. Rather than being piqued or challenged by potential new information, the information-avoidant retardate chooses familiar and highly predictable events to engage. This may provide a basis for order and stability for him in any environment such as the classroom. Of course, at the same time, a potential learning environment becomes a pseudo-learning environment, and the potential learner is then in large measure a pseudo-learner. Behavior which is sometimes characterized as "perseveration" or "rigidity" may be otherwise viewed as ways by which a retarded potential learner can avoid contending with new tasks, i.e., by maintaining the status quo in his purview. Energies expended on behalf of already assimilated information or with firmly established if primitive response skills leaves little room for new learning. Further, irrespective of the cognitive potential of the individual, if there is no attention to the source of potential new information, there is virtually zero likelihood that the new information will be assimilated. Thus, information that could perhaps be managed or assimilated by a retarded individual will not be. Still, rejection of potential new informational sources also precludes the potential stress and frustration which the retardate expects as part of his assumed inability to cope with that information; in this respect, complexity-avoidance is adjustive.

To what extent does the typical special classroom support complexity-avoidance by mentally retarded pupils? There is oblique evidence to suggest that, at the very least, little is done to encourage exploratory behavior. A study by Minskoff (1967) found that, in the relatively small amount of time special class teachers

actually teach (with the major part of the day given over to classroom management), such teaching is typically rote and/or directive. Presumably, rewards for achievement, if any, are cast in terms of whatever has been absorbed through rote-learning. Inductive teaching methodology which would tend to support self-initiated learning is very rare, according to Minskoff, even for teachers who were specially trained in inductive teaching. Rote-teaching emphasizes "right" answers; it necessarily avoids the grey areas of uncertainties and unresolved questions. Teachers who use rote-teaching with retarded children are inclined to seek simple binary "yes or no" answers from their pupils. An information-avoidant retardate has a 50-50 chance of being "right" to such questions in a rote-learning context even if his attention is focused elsewhere.

On the other hand, there is evidence that educable retardates will profit from teaching which is oriented towards increased hypothesis testing by the students. Katz (1962) compared rote and essentially inductive methods for teaching general science units to EMR adolescents and found that, whereas both methods led to equal levels of achievement for basic facts, the inductive method led to greater generalizability of principles subsuming those facts to new events. Thus, direct encouragement of inductive learning can lead to salutary effects for educable retardates. Studies by Goldstein, Moss and Jordan (1965) and Goldstein, Mischio, and Minskoff (in press) have yielded further evidence in this regard.

In the present project, a frontal attack was made on the information-avoidant tendencies of retardates in the training experiment. For about half the Complex-trained subjects, the criterion was accomplished with minimal prompting (initial instructions alone) and therefore, essentially by self-discovery of the correct class or classes of response. The rest of the Complex-trained subjects required a little or more prompting to catch on to the task requirements and accomplish the criterion. The resistance of complexity-avoidance to change was amplified by the fact that half the subjects required at least some additional prompting, in spite of the fact that "incorrect" (simple) choices were otherwise unrewarded. Nevertheless, in all cases, it was ultimately possible to reverse this seemingly intransigent tendency. Not only was change ultimately possible, but performance on the transfer tasks showed that training led to reasonably positive consequences of such as enhanced flexibility in learning and greater persistence in the face of difficulty.

However, the experimental training method and the transfer tasks which test its effects should not be construed as prototypical for classroom application. They merely illustrate the possibilities for change, and for positive effects of change.

One fundamental difficulty with the present training method is that it seemingly skips over what Hunt (1961) has called "the problem of the match," i.e., the correspondence of new information to already extant repertoire in the learner. Probably, a more optimal training approach would seek to move complexity-avoidant individuals more gradually towards acceptance of extreme complexity, e.g., by first reinforcing only moderate complexity, then somewhat more extreme complexity, etc. This could be accomplished with sufficient stimuli and careful scaling.

In the classroom, this gradual approach is characteristic of any good carefully programmed curriculum. An example of such a curriculum for teaching retarded children, and which further makes a decided effort to incorporate inductive teaching methods, is the Social Learning Curriculum currently under development (Goldstein, 1969). Because of its emphasis on inductive learning, it would not be unreasonable to predict that children who profit by instruction in the Social Learning Curriculum or similar method would show greater perceptual curiosity (e.g., complexity choice) than children receiving more traditional training.

In other classroom contexts, the present findings strongly suggest that special class teachers should support and encourage exploratory activity, even if it is rudimentary, whenever it occurs. Such encouragement is probably best given by explicitly extrinsic incentives, but these can presumably be faded out ultimately. (A hint to the probability of occurrence of exploratory behavior is given by the substantial inverse relationship between complexity-choice and socio-economic status, i.e., lower-class MR children are more likely to show exploratory behavior than higher- class MR children). This advice is in a sense problematical because exploratory behavior may be construed as disruptive, and the teacher who nurtures it may be risking management difficulties. It very well may be the case that an environment which encourages exploration and information-seeking is one that pays the price in terms of easy management. However, the opposite can also be true: an easily managed teaching environment may also be the most stultifying environment from the standpoint of independent learning. Of course, it is also possible that an inventive teacher can develop techniques which will promote exploratory behavior by students at no great cost to classroom manageability, e.g., by structuring certain types of games. But ultimately, <u>meaningful</u> exploratory behavior must become again what it was to begin with: a self-initiated and self-sustaining activity.

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Appendix A.

Complexity Choice as a Function of Exposure Time

Berlyne (1963) raised a distinction between specific and diversive curiosity, the former associated with conflict prompted by complexity attributes of stimuli, and the latter prompted by considerations such as aesthetics. With reference to different methods for studying curiosity, Berlyne thought that the complexity-choice approach was more likely to tap diversive than specific curiosity, because of the 3-sec. initial exposure time prior to choice. That is, a 3-sec. exposure time could be viewed as sufficient to guide very deliberate decisions toward more attractive or better organized as compared to more complex stimuli. Hence, Berlyne thought that this might explain why normal subjects in the studies of Hoats, Miller, and Spitz (1963) showed low complexity-choice, i.e., relative to his own earlier findings on perceptual curiosity in normal young adults.

To test this notion, Berlyne (1963) designed an experiment in which for different groups of college students, each member of a stimulus pair was exposed for 0.5 sec., 1 sec., 3 sec., or 4 sec. After each member was separately exposed, subjects chose one of the two for additional viewing. Berlyne found that rate of complexity-choice tended to vary inversely with initial exposure time, although this association was not quite linear. Nevertheless, some confirmation was found for Berlyne's contention.

It should be noted that, in Berlyne's (1963) method, both members of a stimulus pair were not simultaneously exposed, as is the case for our method. Therefore, to test Berlyne's argument more nearly in the context of our approach, the present experiment examined complexity-choice under two additional exposure times, one shorter and the other longer than the standard 3-sec. period utilized in foregoing experiments.

Method

Subjects. Two groups of college students were constituted. For the first group, N=20, stimulus pairs were exposed for 6-sec. initial durations. For the second group, N=16, pairs were initially exposed for 1 sec.

Procedure. All subjects received identical instructions for the VTM as subjects in earlier described experiments. The 90-item series was used, and there were 2-min. breaks between each 30-item pentablock.

Results and Discussion

The first analysis of 1-sec. vs. 6-sec. effects considered complexity-choice for the two groups, with pentablocks as a "within" effect. This analysis is summarized in Table 44.

Table 44.

Analysis of Variance for Complexity Choice on Penta-Blocks as Function of Exposure Time Condition.

Source	df	ms	F
Ss	35	115.45	
Condition (B)	1	2.02	<1
error (b)	34	118.79	
Pentablocks (A)	2	34.78	4.31
AB	2	3.12	<1
error (w)	68	8.06	

Inspection of Table 44 reveals no significant difference between exposure-time groups, and no interaction between exposure time and pentablocks. There is a significant effect for pentablocks for the two groups combined, with means of 16.61, 15.39, and 14.67 for Pentablock I, II, and III respectively. Thus, like 3-sec. exposure studies, there is a trend towards decline in complexity-choice over time.

Subjects' complexity-choice rates for all 90-items, and for each type of pairing, HI-LO, HI-MID, and MID-LO, were classified as complex, simple, or random, as in Experiment III.3, and these rates were compared for the two groups. Table 45 shows the number of subjects in each group so classified.

Table 45.

Frequency Of Subjects Classified As Complex, Random Or Simple Over 90 Items And For Each Type of Pairing In Two Exposure Time Groups.

Stimuli		Classification		
90 items	Group	Complex	Random	Simple
	6-sec.	6	10	4
	1-sec.	6	6	4
HI-LO	6-sec.	2	16	2
	1-sec.	6	6	4
HI-MID	6-sec.	2	18	0
	1-sec.	4	12	0
MID-LO	6-sec.	2	16	2
	1-sec.	4	6	6

In general, Table 45 shows that the distributions of subjects for the two groups do not differ particularly. Comparing the present findings with those for college students in 3-sec. experiments, both 1-sec. and 6-sec. exposure groups are more likely to be classified as random than is true for 3-sec. exposure. This is particularly true for HI-MID pairings, where no subject in either group could be classified as simple, and the overwhelming majority were classified as random. That this is equally true for 6 sec. as for 1 sec. exposures suggests that HI-MID choices are not reflecting errors in discrimination, but are more probably a function of varying selectivity for each HI-MID pair.

Analyses were also conducted on weighted scores for dimensions, and for reflected weighted scores, for the two extreme exposure-time groups. The first of these analyses showed no differences between groups, but differences between dimensions generally consistant with earlier findings, i.e., Amount of Material yielded significantly

higher complexity-choice rates than the other dimensions, and Incongruity tended to be lowest. The second analysis, on reflected weighted scores, showed a Group x Dimension interaction, with the 6-sec. exposure group significantly more strongly transitive on Irregularity of Arrangement and Incongruous Juxtaposition than the 1-sec. group. Table 46 mean reflected weighted scores on dimensions for the two groups.

Table 46.

Mean Reflected Weighted (Transitivity) Scores (Per Item) On Dimensions For Two Exposure Time Groups.

	Dimension						Total
Group	A	B	C	D	E	F	
6-sec.	.90	.82	.94	1.10	.80	.80	.89
1-sec.	1.37	.82	.92	.75	.72	1.47	1.01

With respect to data in Table 46, both groups tend to show moderate-to-strong transitivity for each dimension, somewhat more sharply than had been true for the 3 sec. group. However, in general, findings for effects of extreme initial exposure times do not support Berlyne's contention that brief initial exposures should lead to greater specific perceptual curiosity than longer initial exposures. If anything, results are opposite, e.g., there is a slightly greater proportion of simple-classified subjects in the 1-sec. relative to the 6-sec. exposure group. Since both extreme exposure conditions tend to promote greater classification of subjects as random rather than either simple or complex, generally opposite to findings for 3-sec. exposure, as in III.3, it is concluded that an initial exposure of 3 sec. is optimal for discernment of individual differences with respect to perceptual curiosity.

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Appendix B.

Pupillary Changes in Retarded and Normal-IQ Adolescents as Functions of Stimulus Complexity

During the past several years, there has been a notable rate of studies on the pupillary reflex as an index of an individual's affective state. Much of this work is attributable to the pioneering efforts of Hess and his colleagues (e.g., Hess and Polt, 1964), who have variously investigated size of the pupillary reflex in response to a wide array of stimuli. In the example cited, Hess and Polt examined pupil size during the solution of arithmetic problems of varying difficulty, and found that dilation of the pupil was delayed as a direct function of problem difficulty. Other studies have generally found that, the more attractive a stimulus, the greater the relative pupil size, and the more noxious a stimulus, the smaller the size.

The present study represents an exploratory effort to examine pupil size in MR and N-IQ samples as functions of stimulus complexity. If pupil size systematically varies with complexity of stimuli, this may be construed as yet another index of perceptual curiosity, as well as of interest in its own right.

Method

Subjects. Film protocols for 15 N-IQ and 13 MR adolescents, about half of the subjects originally run, were judged to be of sufficient quality and reliability for inclusion in this study. MR subjects were tested at a summer camp for special class educable retarded children. N-IQ subjects were tested at their respective junior or senior high schools, towards the end of the school year.

Apparatus and Materials. The apparatus employed was the Hess pupillometer, previously described (See Section IV). The 12 best-discriminating stimulus pairs, 2 from each of 6 dimensions, were used as stimuli.

Procedure. Subjects were fixed in position at the pupillometer by means of a bite plate made of dental wax attached to a metal bar. A dental wax impression was initially taken on each subject.

After various camera adjustments, subjects were allowed a 1-min. adaptation to the red light, with instructions to look at the blank screen and away from the light.

After the 1-min. adaptation, subjects were instructed as follows:

"You will see various designs on the screen. I would like you to look at the designs one after the other. There is nothing for you to remember about them. This is not a test. We are interested only in what and how you look at designs."

Following instructions, a control slide (an "X" within a square) was presented, followed by the first experimental slide, which was either the simple or the complex member of a given pair. Pair members were always presented individually. Prior to every experimental slide, the control slide was presented. For 6 of the stimulus pairs, the simple preceded the complex member, while the opposite was true for the other 6 pairs. Each slide was presented for 10 sec. The camera recorded pupils at the rate of 2 frames/sec. There were 2 sec. (4 frames) between each slide.

Following the complex-simple series, and after a brief rest, additional types of stimuli were presented on the pupillometer. Further description is not germane to the present report, but their effects have been discussed elsewhere (Miller, 1967).

After an additional rest, subjects were run on the 30-item series with the VTM, per standard instructions. The 12 stimulus pairs used in the foregoing were imbedded among the 30-item series.

Results and Discussion

Film protocols were analyzed frame by frame, by projecting the film with a Perceptoscope, at a fixed distance from a table where the image of the pupil was projected horizontally. Diameter of each projected pupil (discounting the 4 inter-trial frames) was measured in mm. with a special transparent rule.

The average over 20 frames for each experimental slide per subject was compared with the average over 20 frames for the preceding control slide, and the difference between these averages was calculated, yielding an adjusted average pupil size to each experimental stimulus. Then, the adjusted averages for simple and complex stimulus pair members were compared, and a tally was made of the number of times the adjusted pupil size to simple members exceeded those for corresponding complex members. This score, theoretically ranging from 0 to 12, was called $S > C$.

In addition, an index was calculated for the number of times pupil size was greatest for simple members but where those simple members were not chosen in the 30-item series. This index, called *S, may be construed as an indication of greater complexity-choice in the face of greater attractiveness for simple pair members.

Finally a ratio of *S/S>C was calculated, yielding a measure for dilation to simple members and rejection of these members in the choice series adjusted for the number of instances in which dilation was greater for simple members.

When N-IQ and MR groups were compared on each of these three measures (S>C, *S, and their ratio) there were no significant differences between them. However, for N-IQ subjects taken by grade, despite the very small sample sizes (5,3,4, and 3 subjects representing grades 9, 10, 11, and 12 respectively), there was a significant ($p < .05$) grade effect on S>C, while differences for *S and *S/S>C were not significant. Analysis of S>C results grade by grade showed that 9th graders were significantly less likely ($p < .05$) to dilate more to simple over complex stimuli than were 12th graders.

The N-IQ group was then split, 9th and 10th grades vs. 11th and 12th grades. This showed a significant difference ($p < .05$) for *S/S>C ratios, with lower grades significantly more likely to reject simple stimuli for which they had earlier shown relatively greater dilation. The difference on *S was more marginal, with $< .10$ $p > .05$.

MR and N-IQ groups differed significantly on their complexity-choice rates, as per earlier findings, with an average rate of 16.40 out of 30 for N-IQ, and an average of 11.00 for the MR group. Similarly, despite the small samples, there was a significant effect on complexity-choice for grade level, just as with earlier findings, with 9th graders significantly exceeding 12th graders. Since complexity-choice rate is reflected indirectly in the *S/S>C ratios, are differences on that ratio a mere artifact of the complexity-choice differences? This is thought not to be the case, in view of the significant S>C effect for N-IQ subjects by grade level. That is, the ratio difference for upper vs. lower grades appears to be independent of complexity-choice differences for grades, despite the fact that the results yielded by each measure are similar.

A comparison of the results for complexity-choice and for *S/S>C ratios is possible on inspecition of Figure 16, which shows results for these two indices in the present sample for N-IQ and MR subjects as a function of grade level or equivalent. Despite the apparent congruence of choice and ratio

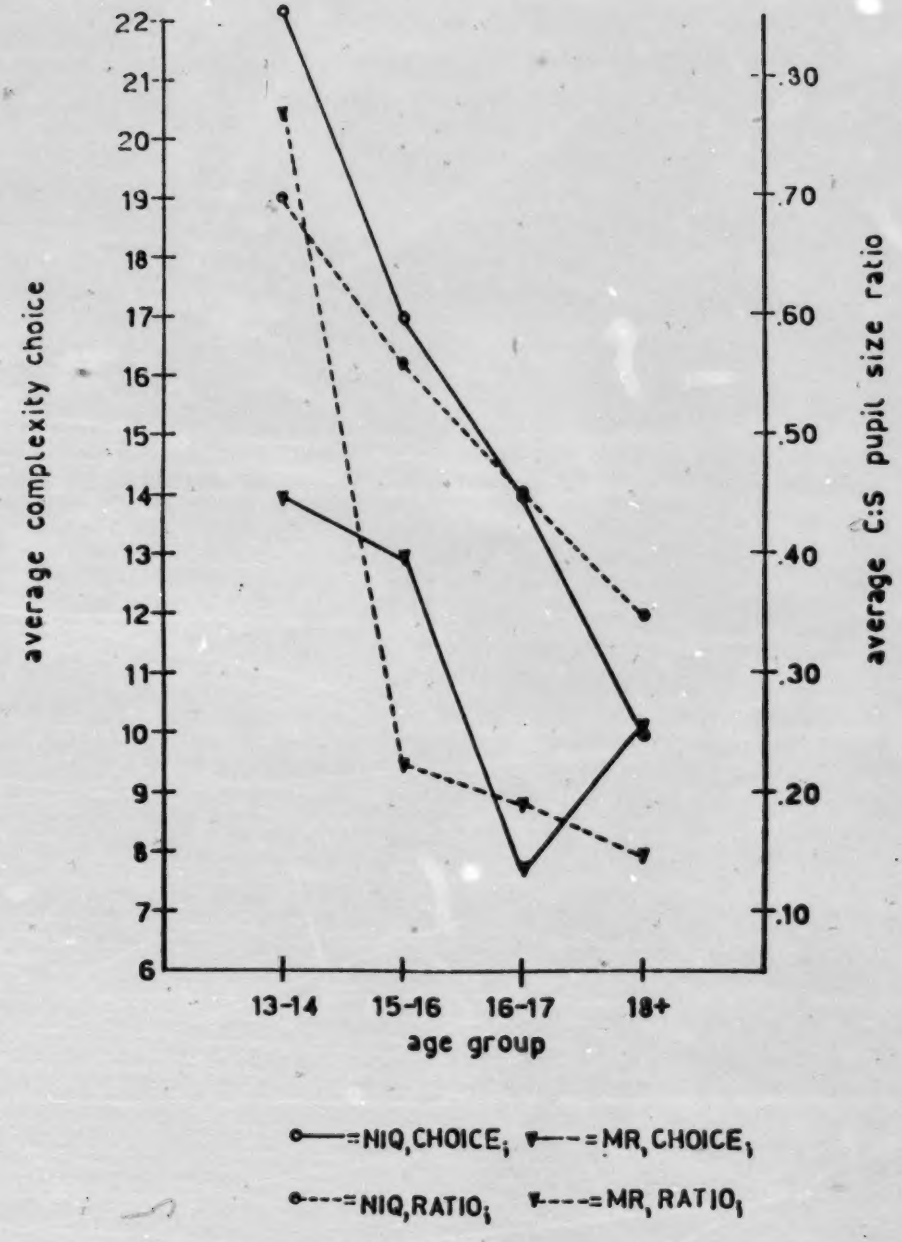

Figure 16.
Adjusted pupil size ratios (*S/S>C) and complexity-choice rates as function of grade level or equivalent in MR and N-IQ groups.

effects for N-IQ subjects, the correlation between these two measures is -.197, which is not significant.

In general, it is concluded that pupil size will show the effects of stimulus complexity. Apparently, for N-IQ subjects at least, there is a tendency for complexity-choice to occur to those stimuli which are either less attractive (in terms of affect) or less immediately comprehensible (in terms of problem-solving). The latter interpretation is particularly consonant with Berlyne's (1960) notion that curiosity is prompted by conflict, which has in turn been aroused by the properties of complex stimuli.

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Appendix C.

O A M Scale

Name _____

Instructions: For the following statements, indicate the extent to which the statement is true for you by circling the point over the position which applies to you. For example, if statement is "never true" for you, circle the short vertical line on the extreme left of the scale. If a statement is "often true" for you, circle the fourth vertical line from the left. And so on.

Please be completely honest in your answers. Your grades will not be affected in any way by what you do on this scale.

****

1. When I know there are going to be one or two questions on an exam from outside reading assignments, I always read all the material.

Never True	Rarely True (once in a great while)	Occasionally True (less than half the time)	Often True (more than half the time)	Usually True (almost all the time)	Always True

2. I regard myself as a more consistent and harder worker in my classroom assignments than the typical student in my classes.

Never True	Rarely True	Occasionally True	Often True	Usually True	Always True

3. Other people (not my good friends) think of me as one who "misses some of the fun" because I am so serious.

Never True	Rarely True	Occasionally True	Often True	Usually True	Always True

4. My fellow students in school think of me as a hard worker.

Never True	Rarely True	Occasionally True	Often True	Usually True	Always True

5. Most of my teachers probably think of me as one of their hardest workers even though not necessarily one of the brightest.

Never True	Rarely True	Occasionally True	Often True	Usually True	Always True

6. Other interests (sports, extra-curricular activities, or hobbies) prevent me from obtaining an excellent rating or mark for effort in school work.

Never True	Rarely True	Occasionally True	Often True	Usually True	Always True

7. I have a very strong desire to excel academically.

Never True	Rarely True	Occasionally True	Often True	Usually True	Always True

8. I try harder to get on the dean's list or honor roll than the average student in my class.

Never True	Rarely True	Occasionally True	Often True	Usually True	Always True

9. I try to do most jobs at least a little better than what I think is expected.

Never True	Rarely True	Occasionally True	Often True	Usually True	Always True

10. I tend to give up or delay on uninteresting assignments.

Never True	Rarely True	Occasionally True	Often True	Usually True	Always True

11. When I fail, I am more likely to start out on a new interest than try harder in the thing at which I failed.

Never True	Rarely True	Occasionally True	Often True	Usually True	Always True

12. My friends are more likely to see me as casual and carefree than as responsible.

Never True	Rarely True	Occasionally True	Often True	Usually True	Always True

Appendix D.

Name _____

Date of Birth _____

RI Scale (Prelim.)

(Note: Do not explain alternatives.)

You know, different people like different things. For instance, some people like cherry pie, and others like apple pie. Which do you like, apple pie or cherry pie? (Pause) Well, you just happen to like _____ better than _____. It could have been the other way around, right? Same for swimming at a pool or swimming at the beach. Which do you like better? (Pause). If you said the opposite, if that's the way you felt, it would have been perfectly all right. It's your opinion.

Now, I would like to get your opinion about some other things. There's no right way and no wrong way to have an opinion. It just depends on how you feel about it. So please tell me exactly how you feel for each of these. Okay?

For instance:

1. What would you rather see,
   _____c. A movie you had already seen and like OR
   _____r. A movie you never saw before?

2. What would you rather eat,
   _____r. Some food which you never tasted before OR
   _____c. Familiar food like a hamburger or hot dog?

3. What would you rather see,
   _____c. A movie your friend told you was good and that he liked it OR
   _____r. A movie your friend hadn't seen yet?

4. Which would you rather hear,
   _____c. A record you had heard before and liked OR
   _____r. A record you never heard before?

5. Which would you rather read,
   _____r. A story you never read but heard was good OR
   _____c. A story you read before and liked?

6. Which would you rather read,
   _____r. A story you never read and didn't know about OR
   _____c. A story you never read but heard was good?

7. Which would you rather see,
   _____r. A T.V. show about Chicago or Los Angeles OR
   _____c. A T.V. show about New York?

8. Which would you rather see,
   _____c. A T.V. show that you liked and is being repeated OR
   _____r. A T.V. show that you never saw before?

9. Which would you rather learn,
   _____r. A lesson you can understand on a new way to do long division OR
   _____c. A lesson you can understand on adding and subtracting?

10. Which would you rather learn,
    _____c. A lesson about fixing the engine of a car OR
    _____r. A lesson about fixing an engine from a jet plane?

11. Which would you rather hear,
    _____c. A lesson about how the heart works OR
    _____r. A lesson about how the pancreas works?

12. Which would you rather get,
    _____r. A movie and talk about Fiji or Tahiti OR
    _____c. A movie and talk about Hawaii?

13. Which would you rather find out,
    _____c. Who invented the telephone OR
    _____r. Who invented the bathtub?

14. Which would you rather hear,
    _____r. A lesson on taking proper care of your feet and toenails OR
    _____c. A lesson on taking proper care of your teeth?

15. Which would you rather hear,
    _____c. A lesson about Columbus discovering America OR
    _____r. A lesson on whether the Vikings or Columbus discovered America?

16. Which would you rather learn,
    _____c. A lesson on what foods are good for you OR
    _____r. A lesson on how your emotions work?

17. Which would you rather find out,
_____r. How a foreign government is run OR
_____c. How a grocery store is run?

18. Which would you rather learn,
_____c. How to open a bank account OR
_____r. How different foreign money is used?

19. Which would you rather learn how to paint,
_____c. A house OR
_____r. Scenery for the stage?

20. Which would you rather learn,
_____r. How a computer works OR
_____c. How a T.V. set works?